Consulting Engineer

June 1959

Photo by Curtis Studio, Los Angeles, Cal.

RALPH M. WESTCOTT, president of Holladay & Westcott, of Los Angeles, and newly elected president of the Consulting Engineers Council, says that he got into engineering through the back door. Whichever door it was, he did manage to take a long look around the yard before lifting the latchstring. The 1959 edition of *Who's Who in Engineering* shows that he went to U.C.L.A. for three years, but it was 15 years between his freshman term in 1923 and his last term in 1939. In between he was far from inactive. *Who's Who*

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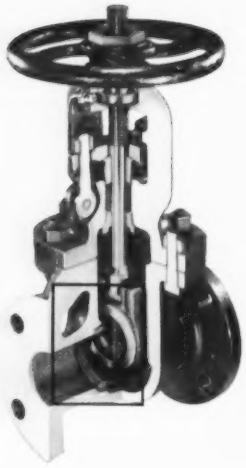

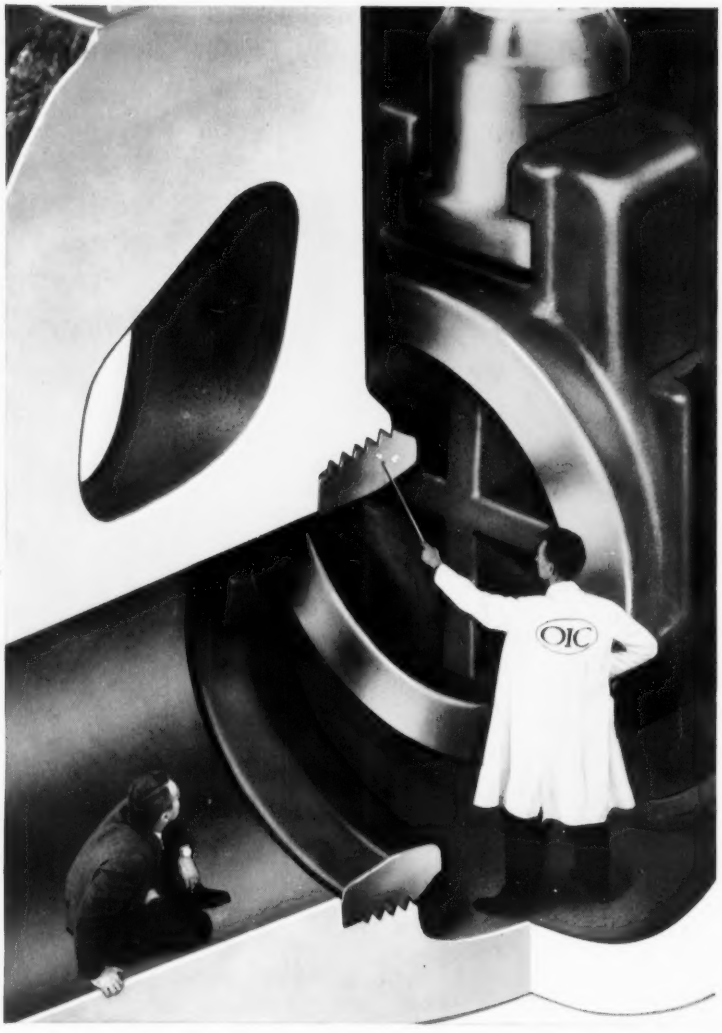

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Old-style shoulder-seated ring cross section

OIC end-seated ring cross section

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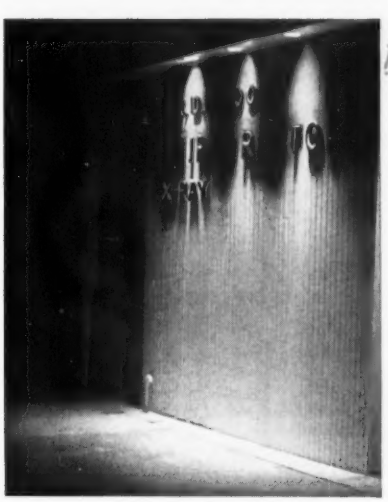

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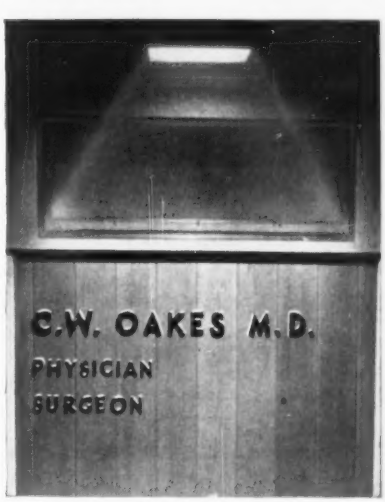

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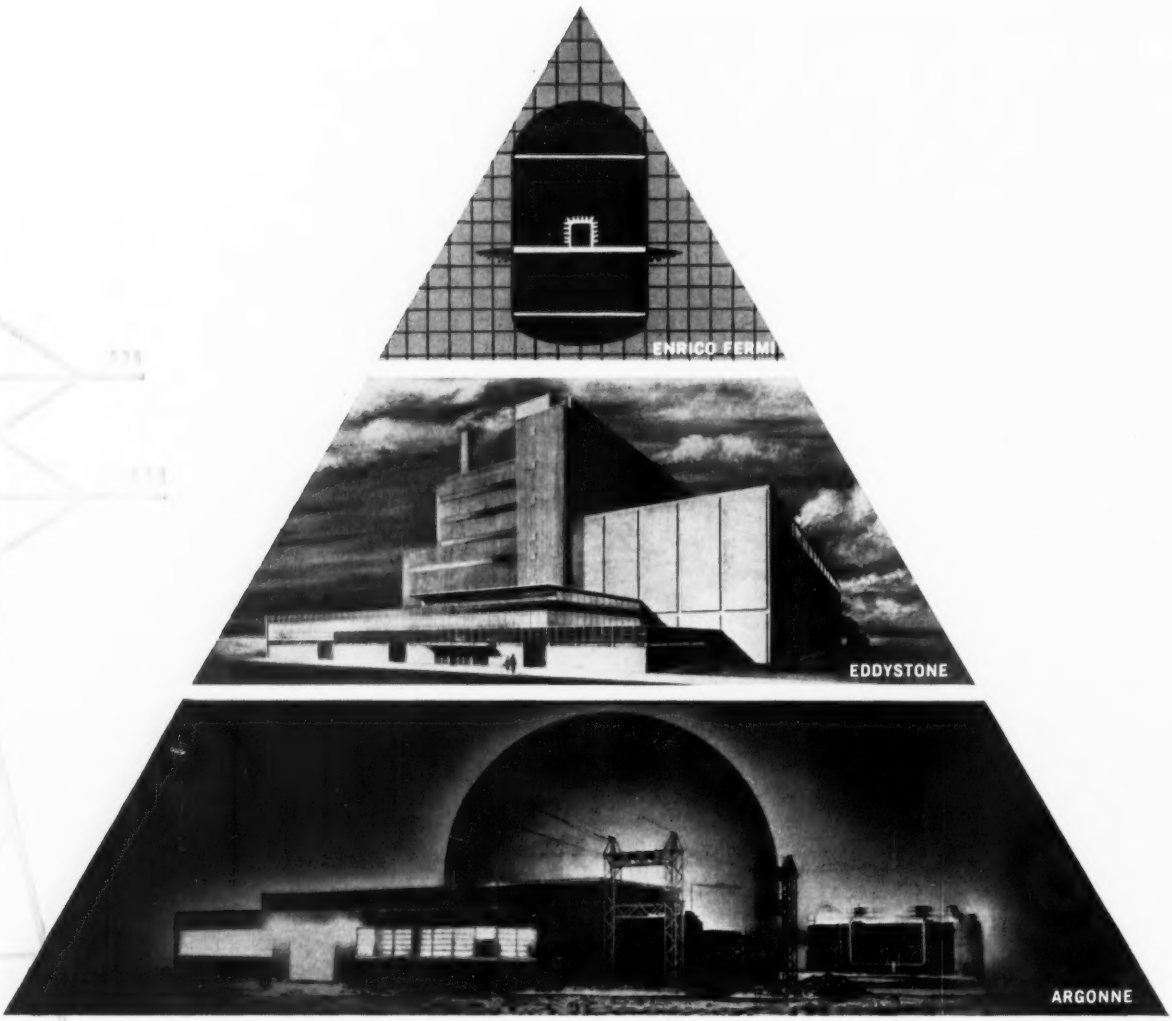

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June 1959 • VOLUME XII • NUMBER VI

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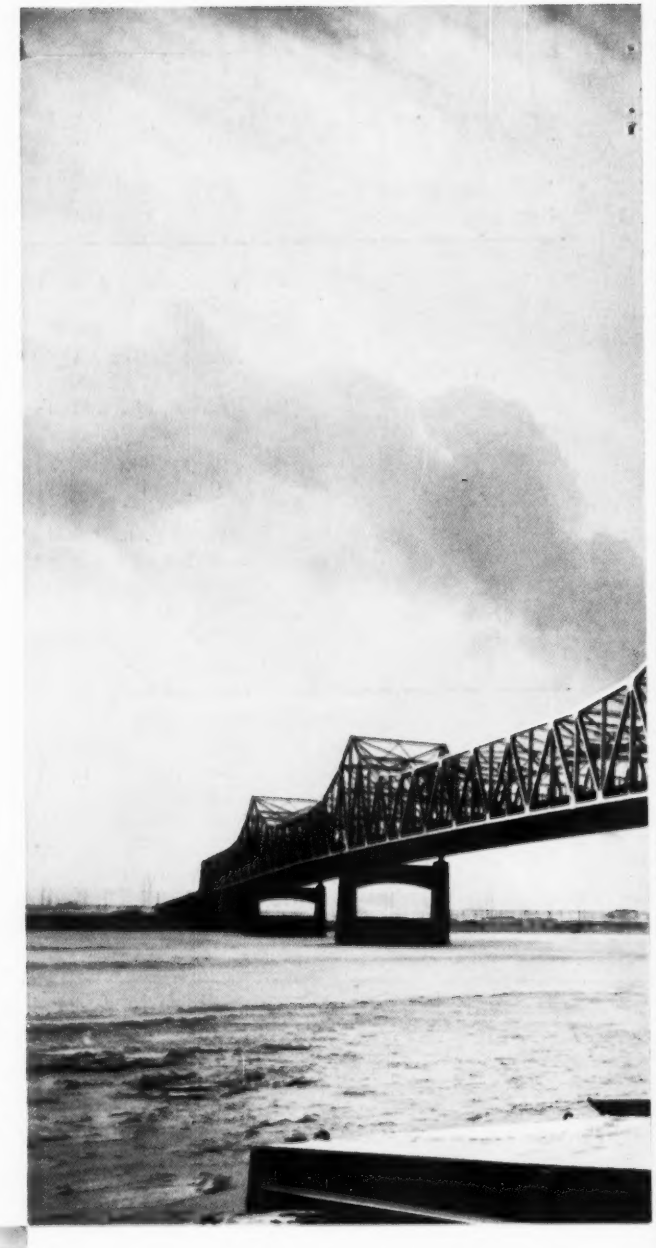

Five-span cantilever bridge, Peoria, Illinois, carrying two 26-foot roadways. Total length of spans—2,340 feet. Designer: State of Illinois, Dept. Public Works and Buildings, Division of Highways. Fabricator: Allied Structural Steel Cos. Erection by Industrial Construction Co.

$175,000 was saved by the use of USS TRI-TEN Steel in heavily stressed chords and diagonals, where it eliminated 850 tons of deadweight.

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Ralph M. Westcott

— *Starts on front cover*

lists him as a printer, a date grower, and the owner of the Ralph M. Westcott Water Treatment Service. It fails to mention that he was also an avocado salesman, and a manufacturer of scientific photographic slides.

Westcott started his water treatment service company in 1940 and did quite well with it, selling out in 1949 because he decided he wanted to be an impartial consultant on water quality problems and refrigeration. His experience in the water treatment field also had alerted him to the existence of several insidious and irresponsible water treating gadgets. He undertook a campaign to expose these devices as fraudulent – a campaign which is being continued. These efforts were partially rewarded when the FTC recently issued a final cease and desist order against one of the most flagrant promoters of such equipment.

Enters Private Practice

The fact that he received his engineering registration from the California Board in 1948 had something to do with his decision to leave sales and stick to consulting services, for he was now a registered mechanical engineer. As a result of his personal experiences with water treatment quacks and promoters, few engineers entered private practice with a stronger concept of business and professional ethics and a clearer understanding of the importance of competent and independent engineering advice. Just three years later, in October 1952, he entered into a partnership with Bill Holladay, and they founded the firm of Holladay & Westcott, now one of the better known and most respected engineering firms on the West Coast.

Holladay & Westcott specializes in engineering services for the design of facilities. Its list of clientele includes many well-known manufacturers and industrial organizations in Southern California as well as several research and educational institutions. Ralph Westcott himself is recognized as an authority in the field of industrial waste disposal and water quality control for manufacturing processes and heat transfer.

Society Memberships

Westcott is a fellow or a member of scarcely more than the normal number of engineering societies – ASRE, ASME, AWWA, NACE, and the Consulting Engineers Association of California, as well as a few others. But Ralph Westcott seldom simply joins a society; he leads it. He has the forceful, bright, and enthusiastic personality that every society is looking for to fill its offices, and he is rarely a member of a society for more than a few months before he holds one of those offices. Frequently he ends up in the president's chair.

His experiences in the Consulting Engineers Association of California are typical. He heard of the group just two months after he and Bill Holladay opened their office, and they joined immediately. He never has missed, since that time, an annual meeting, and he has attended every monthly luncheon meeting unless business has called him out of town. He not only attended the association meetings, he worked on every committee assignment he was given. It was only natural that in 1955 he was elected to the board of directors and in 1956 became the association's president. He served them so well that he was re-elected in 1957.

Meanwhile, at the end of 1955, the Consulting Engineers Association of California had joined with nine other associations of consulting engineers to form the Consulting Engineers Council. The Council became a functioning organization in July 1956, and Ralph Westcott attended that organizational meeting in Tulsa as a member of the Council's board of directors, representing CEAC.

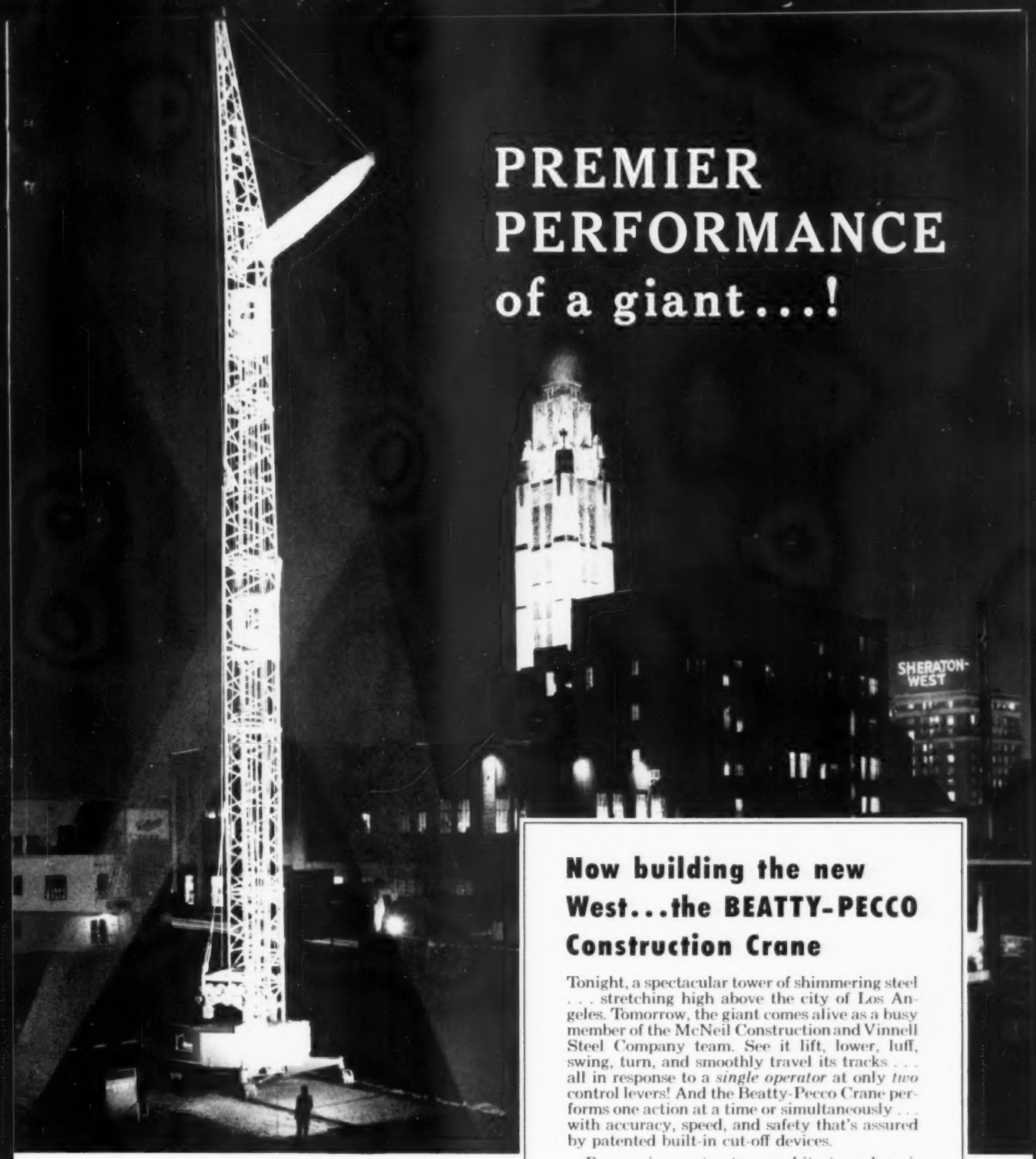
Again, it is only natural that this year Ralph Westcott moved up to the presidency of the Council; he took office at the Annual Board Meeting in New York, on April 30 - May 2.

Views on Consulting Engineers Council

Westcott has some definite ideas about the Council and the way it should work for its members. As he took on this newest and most important association job of his career, he had this to say in an exclusive interview with CONSULTING ENGINEER:

"To understand the Council and its accomplishments and shortcomings, it is necessary to understand that it is not yet a truly united group; instead it is still a federation of separate associations of consulting engineers. Some of these associations are strictly local, New York City and Chicago, for example. Some are state-wide such as Missouri, Oklahoma, Georgia, and our association in California. Still others are at least theoretically regional, the Gulf Institute and the Intermountain Institute. There are large associations with many members, and very small associations made up of just a few firms. A few associations limit their membership to engineers in interprofessional practice – others lean heavily in the opposite direction.

"Actually, we have only one common characteristic: all the members of all the associations are engineers in private practice who have no connection with sales, manufacturing, or contracting. That gives us a reason for being and holds us together because it means that despite our differences we have common problems of fees, ethics, and business



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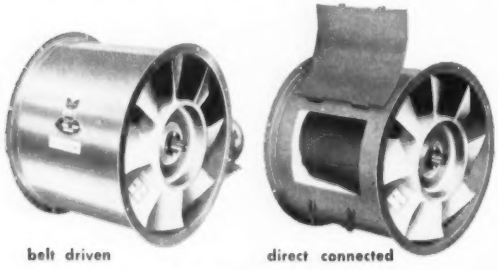

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procedures. All of us are interested in seeing to it that there is more and more work for the independent consulting engineer, that he does a technically competent and professionally ethical job for his clients, and that he is fairly paid for that work.

"It is, however, to the variations in organization and operation, and consequently the variation in organization philosophy, that we owe most of our current problems. We might say that the Council is now in a stage similar to that of the United States when it functioned under the Articles of Confederation, and it is time that the associations in the Council recognize that it is necessary for us to get together and 'form a more perfect union' and transfer some of our local autonomy to the national organization.

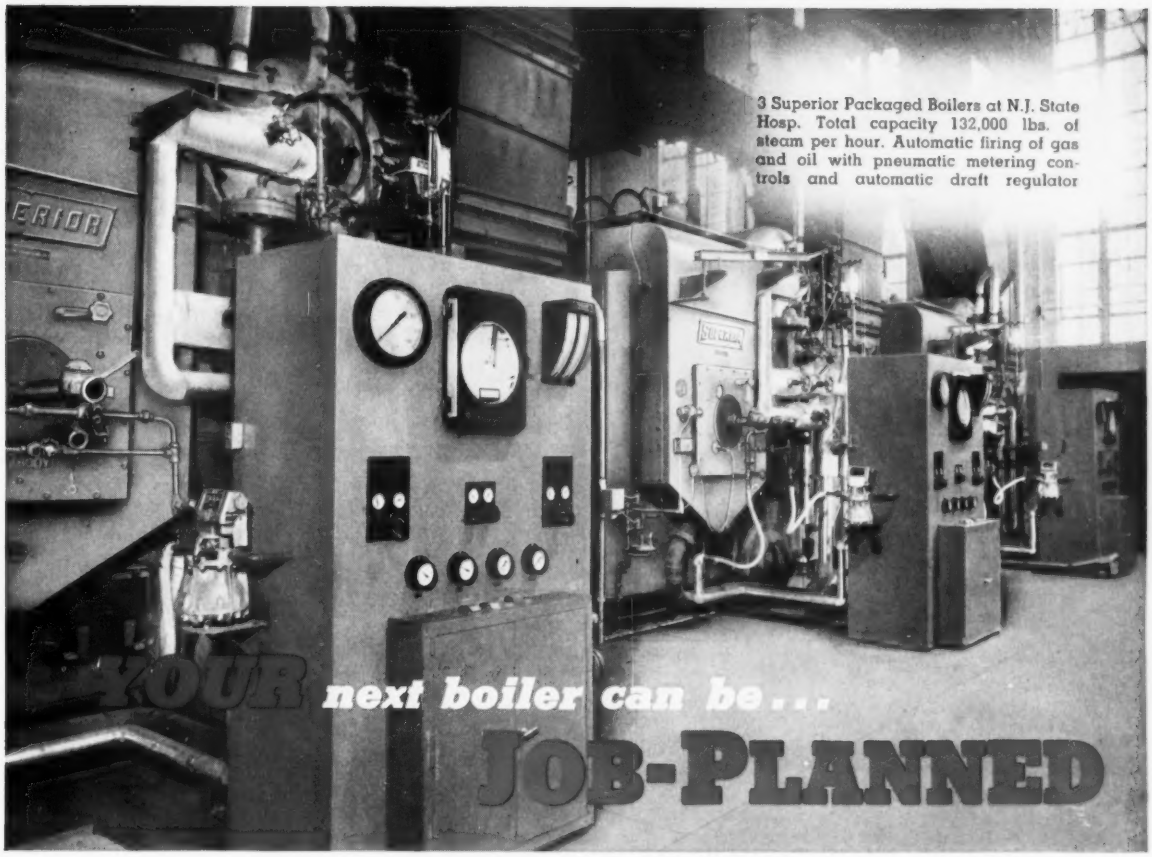
"Last year the Council joined the International Federation of Consulting Engineers (FIDIC), and as much as I approve international cooperation, I am afraid that we have got our United Nations before we have got our United States. Therefore, I see it as the job of our Council board of directors to bring our loose federation closer together and develop an organization that can act for the whole while still carefully preserving the authority of the separate associations on local levels.

Membership Concept

"In my opinion this can be done best by reconstructing the whole membership concept of the Council. Currently, the only actual members of the Council are the several member associations. I feel we must change this so that individual consulting engineers, the men who are now members of their local associations only, can also become members of the Council.

"This would have many advantages. It would permit each consulting engineer to refer to himself on his letterhead and on his business card as a member of Consulting Engineers Council. It would give some meaning to our Code of Ethics, for ethics can apply only to persons, not to associations. It would permit direct participation of the individual members in every activity of the Council, and would give us a large enough membership, in numbers, to permit us to take our place with more effect in the councils of the major professional societies, such as Engineers Joint Council.

"That alone is not enough. I think that we should set up an organization in which financial support is by firms but participation is by the principals of those firms. This is only logical, for the firms are the business structures through which engineers practice their professions. The owners, partners, and principals are professional engineers individually, but their firms are legally and actually business organizations through which the professional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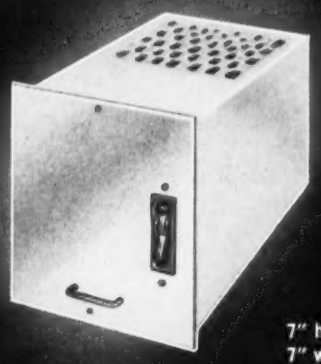

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engineers practice. The Council is not a technical society; it is not a professional society of individual engineers; it is a business association working for the well being of independent consulting firms. For this reason, the Consulting Engineers Council should be supported by dues paid by firms on some equitable basis that takes into account the size of the firm and the extent of its work.

Owners, Partners, or Principals Only

"The firms, however, cannot of themselves participate in association activity. It takes people to serve on committees, to prepare and carry out programs, and to deal with other people. Therefore, I think that our actual participants should be the owners, the partners, or the principals of the firms that pay the dues. The Council always has held that only the men responsible for their firms, the men who can speak for their firms, can be members. That is as it should be in this group, for we deal only with matters that have to do with the ownership and management of firms of professional engineers engaged in private practice.

"To sum up this point, I would like to see established a dues formula that would assess appropriate dues for each firm affiliated with the Council. I would then like to see each owner, partner, or principal automatically become a member of the Council through his firm's affiliation. And the closer each of our associations comes to adopting this form of organization for itself, the stronger the Council will be. If this plan were adopted now, (and not counting the new associations just accepted into the Council at the New York meeting) we would have a Council supported by dues from about 1000 affiliated firms, and we would have the active participation of perhaps 2500 owners, partners, and principals of those firms. Each principal would be an individual member of the Council and could refer to himself as such.

"I know that this would represent a major change from the federation of associations that we now have, and I doubt that the change can be completed in one year – but we can surely get things started toward an ultimate solution.

The Road to Maturity

"This would represent a very great step toward maturity for the Council. Maturity is what the Council needs more than anything else. There is no reason we should expect to be very mature at this point, for we are only three years old, and some immaturity is to be expected. But we must be sure that we are prepared to accept the responsibilities we are seeking to assume.

"Part of our trouble, to put it frankly, may be in personalities. When the Council was started, each

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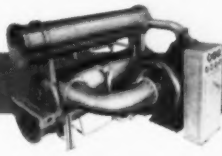

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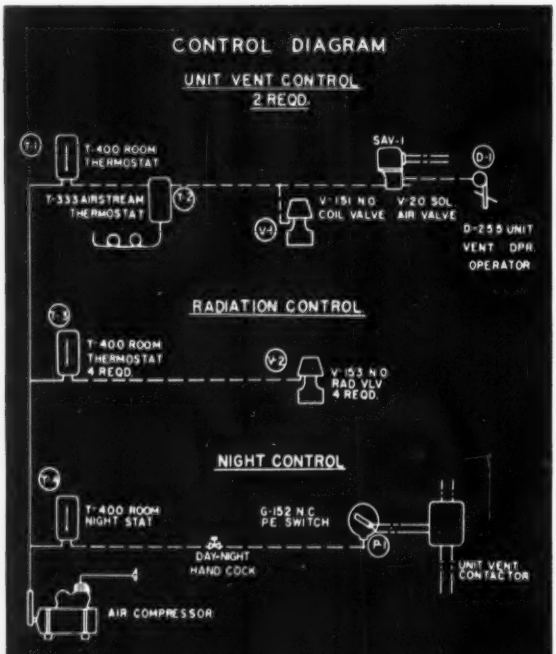

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Are pneumatic controls practical for a 2-room schoolhouse?

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When you specify Johnson Pneumatic Control, you are sure of the best. Every Johnson system is engineered and installed to meet the requirements of the individual job. Small installations are done as carefully as the large ones for which Johnson is so well known. Quality and efficiency is as high in the smallest as in the largest system.

The specialized Johnson organization offers you the most complete line of pneumatic temperature, humidity, and pressure control equipment obtainable today. Over 74 years of control experience are behind every Johnson installation.

Engineering, installation, service and sales facilities are available at 105 direct branch offices. Call your local Johnson branch or write Johnson Service Company, Milwaukee 1, Wisconsin.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

association sent its strongest and most active men to the board, and this was as it should be. They served so well and so energetically, it was only natural that in most instances these same men were returned for a second and then for a third term. Experience is a fine thing, but it is also true that there must be some provision made for change of representation. We have to grow through participation by more persons. The associations must realize that the more of their own members that have seen service on the Council's board, the more the other members back home are going to know about what the Council is and what it is accomplishing.

Importance of New Faces

"Varied representation also brings new ideas and new solutions into the Council itself. I do not think we should put any limitation on the number of terms a director can serve on the board, but as a general rule, I think the associations should recognize the advantages of having a man serve one year as an alternate, the next year as a member of the board, and the next year back home as an advisor to the new board member. There are exceptions, and these should be recognized, but often a man too long in office tends to impose his own personal opinions and prejudices on the board at one end and on his own association at the other. Occasional changes in office would avoid this.

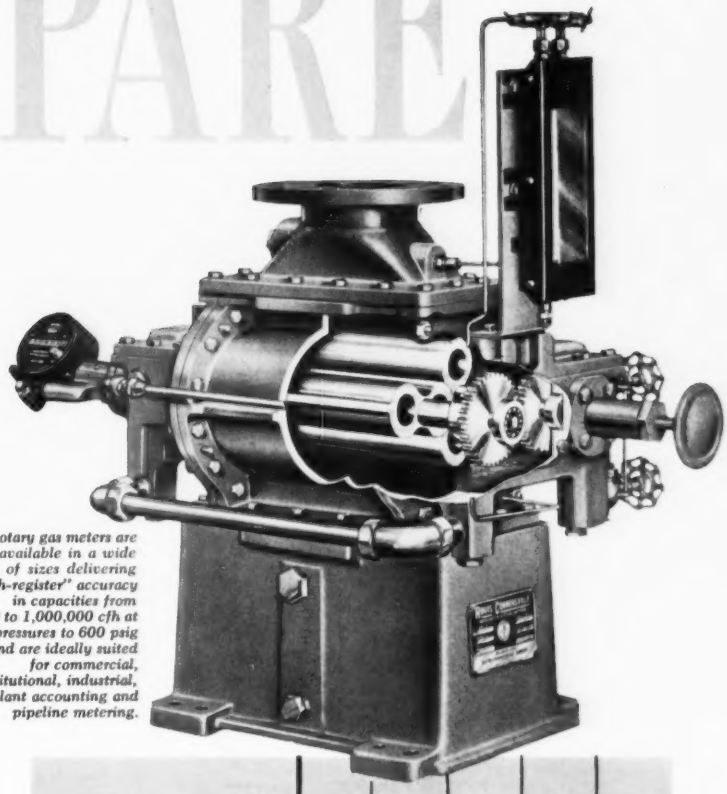
"In discussing this matter, I am thinking, however, more of the future than of the present, for the current board of directors, both in the new and in the older members, represents as self-sacrificing and dedicated a group as I have ever seen.

"Men like John Pryke, Ed Wolff, and Charlie Pate, the first three presidents of the council, have given up an unbelievable amount of time and contributed much of their own money to the work of the Council. These men have traveled all over the country to meet with manufacturers, contractors, architects, government officials . . . all in the interest of their fellow consulting engineers. We have had to depend largely on these volunteers because we have not had a budget sufficient to support a full office staff. Our office is in Springfield, Illinois, not because we think that this is the ideal location for an association office, but because that is where our elected secretary, Len Crawford, has his own consulting offices. We needed him, a volunteer, to guide the office in its early months and direct the activities of our newly employed executive secretary and his office assistant. The Council was able to work not because it had money but because of the exceptional efforts contributed by a few highly dedicated members.

"While it is true that love makes labor light, I think we have demanded too much of too few, and

COMPARE

More Capacity At Less Cost With R-C Rotary Gas Meters



R-C rotary gas meters are available in a wide range of sizes delivering "cash-register" accuracy in capacities from 2,000 to 1,000,000 cfh at pressures to 600 psig and are ideally suited for commercial, institutional, industrial, interplant accounting and pipeline metering.

Comparative Analysis	SPACE OCCUPIED	TOTAL CAPACITY	METER COST	INSTALLING COST	TOTAL COST
FOUR DIAPHRAGM METERS					
ONE R-C METER					

As the comparative chart indicates, cost is reduced and capacity is increased with R-C rotary positive displacement meters. The total capacity of one R-C meter exceeds that of two or more diaphragm meters. Both initial cost and installing costs are substantially lower. Their small space requirements permit installation in otherwise unusable space. And operating costs are held to a minimum, since maintenance is confined almost entirely to lubrication of gears and bearings and to an occasional check of the operating differential.

Roots-Connersville rotary positive displacement gas meters provide a 15:1 operating range – metering unmatched by any other design. Precision-machined measuring chambers insure unalterable accuracy unaffected by variations in specific gravity, rate of flow, pulsations or impurities. And there are no valves, diaphragms or other small parts to wear and cause inaccuracies.

Pressure drop is minimized, since R-C's straight-through design eliminates winding passages and restricting ports. Even at low flows, these meters retain "cash-register" accuracy. These advantages are the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.

For additional data, please refer to pages 565-568 in **Chemical Engineering Catalog,** *our section in* **Mechanical Catalog** *or write for* **Bulletin M-258**

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● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

Because of the utter simplicity and dependability of its magnetic principle, Magnetrol has *infinite operating life.* There are no wearing parts to get out of order.

Magnetrols are available for controlling level changes from .0025-in. to 150-ft., with single or multi-stage switching. Our experienced engineering staff is at your service.

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Please send me catalog data and full information on Magnetrol Liquid Level Controls.
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that it is time we let some of our overworked board members get back to making a living. I think we should be able to employ more office help, we should be able to pay the expenses of our members who travel about the country on Council work, and we should be ready to get on with some of our more expensive but much needed projects, such as our publicity and public relations programs.

The Necessity for an Adequate Budget

"We cannot accomplish these essentials without an adequate budget. In 1958-59, we operated the Council on a total income of about $40,000. That averages only $40 per firm for the 1000 firms in the Council. That is nowhere near enough, yet there are still some who feel that our dues are too high. They argue from opposite ends. In California our local association dues are high, averaging about $200 per member. Because of this some of our California members feel that the addition of the Council dues to the total they are already paying runs the bill up beyond reason. On the other hand, there are some associations with very low local dues of $15 to $25, and here there is a tendency to feel that the Council dues are out of line with the local.

"The fact is, though, that the Council needs at least $60,000 to $70,000 to operate at the very basic minimum during 1959-60. Part of this increased budget will come from increased membership, but we must face now and each year in the future the fact that we need an adequate budget if we are to be more than a badge and banner society. We need not only a new dues formula that fairly spreads the cost among the firms, but we also need one that provides more than the bare minimum required for the Council's existence.

Office in Washington Must Wait

"It is because of our lack of money that I favor keeping our office in Springfield for another year. I know that the office should be in Washington, but I do not want to go to Washington and set up an office until we can afford suitable office space and a greatly expanded headquarters staff capable of dealing with the professional, business, and trade groups now located in Washington. We simply are not ready financially, but I hope that we will be a year from now.

"There are, as I see it, two other immediate problems facing the Council. One is finding a means for more direct participation of individual members in Council activity and better communication between the board of directors and the consulting engineers they represent. I do not think it is yet time for us to hold a general national meeting — we have not yet arranged for individuals

We're in Chicago, looking at the massive, new addition to Wesley Memorial Hospital. This outstanding hospital required added space to keep up with today's growing patient load. And because Wesley Memorial *is* so busy, everything in this new wing has to be reliable and permanent!

Pierce Electric Company, electrical contractors, met this need for extra reliability and permanence with almost 25,000 ft of rugged Roebling Electrical Cable—in sizes from 500 MCM to #4 AWG.

And hundreds of contractors, on every kind of construction, do just as Pierce Electric Company did! For experience teaches that when you want electrical wire and cable you can count on to do the job perfectly, one choice—ROEBLING—stands out!

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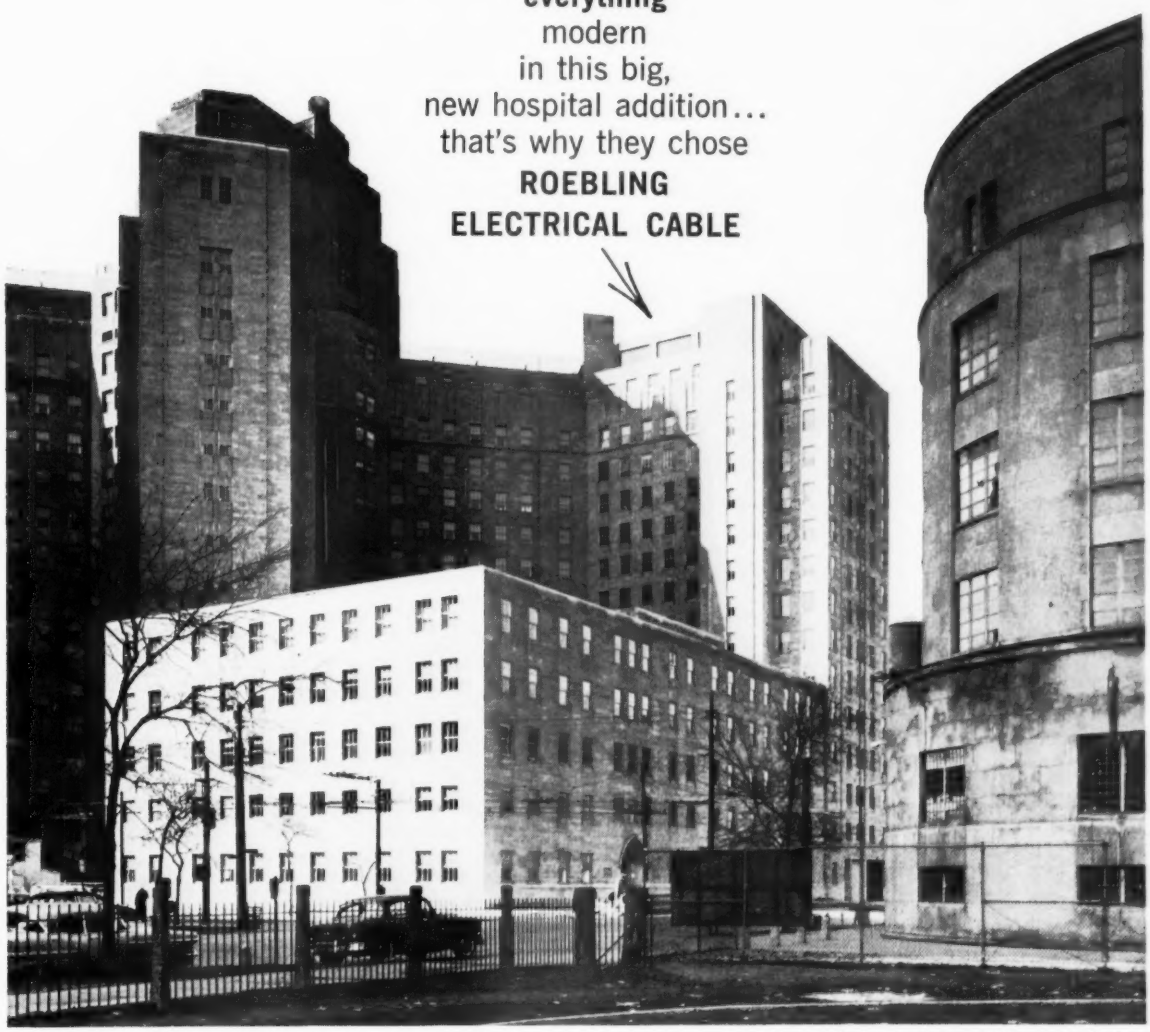

EXPANSION! Chicago's Wesley Memorial Hospital grows with growing demands. This is the attractive new North Wing. Architects: Fugard, Burt, Wilkinson and Orth. General Contractors: Gust K. Newberg Construction Co., Inc. Electrical Contractors: Pierce Electric Company. Electrical Distributor: Chicago Electrical Supply Co., Chicago, Ill.

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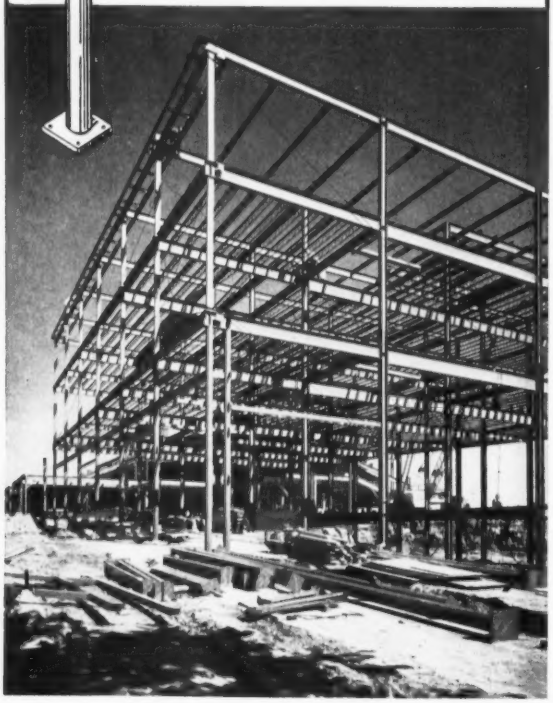

to become members, but we certainly must plan for that, perhaps as early as in 1960 or 1961.

"The second problem, and an even more pressing one at the moment, is that of a growing unwieldiness of the expanding board of directors. We have one member and one alternate from each association. In 1958, that meant 40 persons sitting about the director's table plus several officers of the board. At each meeting we had to arrange for the seating of about 50 participants. That is more than a board of directors can have and still be the actual administrative as well as the policy-making body. This year, with our new association members, we will have an even larger board. We should now turn this board of directors into a broad policy group and leave the actual administration of Council affairs to the executive committee. This is essential to the proper operation of the Council. I believe that most of the members of the board understand the need for this transfer of authority to the executive committee, and I feel sure that this year will see that change take place.

Dealings With Other Organizations

"I also look forward to this year as being one in which the Council can cooperate fully with other groups with which consulting engineers must deal. I know that we will be able to work more closely with the national technical societies through our membership in Engineers Joint Council. I recognize, also, that there are many activities in which there is a fine and shaded line between the proper sphere of activity of a professional society made up of individuals and a business organization primarily representing firms of professional men. Because of this, and because most of the principals of the firms represented in our associations are members of their State and National Societies of Professional Engineers, I look forward to closer cooperation between the Council and NSPE. I also know that we want to deal directly and closely with the American Institute of Architects on the solution of interprofessional problems. And we certainly want to work more closely with the Producers' Council through our joint committee, and with other manufacturers' associations, too. That leaves the contractors, who are of great importance to us, and we want to discuss mutual problems with them through their organizations on a national level. We will continue, of course, our most effective dealings with government officials through our Washington Liaison Committee.

"I know this looks like a mammoth job, and it is. We will not accomplish it all this year, but I do want this to be a year in which the Consulting Engineers Council continues to mature as rapidly as our talents will permit." ▲▲

* A PERFORMANCE BRIEF

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Brawniest of three Trackmobile models, this 5TM is one of six operating at a leading taconite mine. This powerful team handles and positions 100 ore-laden cars a day . . . shuttling back and forth over road and rail to keep production moving on schedule. Economical and easy to operate, Trackmobile is ideal for every switching, spotting and hauling assignment.

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OPERATING ROOM QUIET is maintained even though a Westinghouse DS-3 dry-type transformer is only a few feet away. "Only well-engineered equipment," states architect Calvin M. Butler, "can achieve both the quiet and constant operation demanded in this location."

Compact new Westinghouse dry-type transformers give "virtually silent" operation in Arizona hospital

Quiet operation and compact construction dictated the choice of Westinghouse DS-3 dry-type transformers for the new Louis Galland Memorial Wing of St. Luke's Hospital in Phoenix, Arizona.

"The importance of quietness in a hospital cannot be overemphasized," comments Mr. Calvin M. Butler, architect of the new wing. "In this instance, the transformers are installed next to the surgical and X-ray rooms where the loud humming often associated with transformers would have disturbed both doctors and patients. The Westinghouse dry-type transformers used here are practically noiseless. No decibel reading whatever can be obtained, even when a meter is placed on the transformer surface."

"In addition to their virtually silent operation," adds Mr. Archie W. Brown, consulting electrical engineer, "these transformers provide a greater margin of safety for overloads and operation in higher ambient temperatures. Yet they are smaller than others designed for the same kva output."

Quiet operation of the DS-3 is assured by use of a new "built-in" mechanical vibration dampening system, which floats core and coils independently of base, case and connecting conduit.

Reduced size—up to 11%—and weight—up to 32%—achieved by use of two Westinghouse exclusives: inorganic Silclad insulation and grain-oriented Hipersil® steel cores.

For full information on the advantages of the DS-3 transformer, call your local Westinghouse salesman or distributor . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

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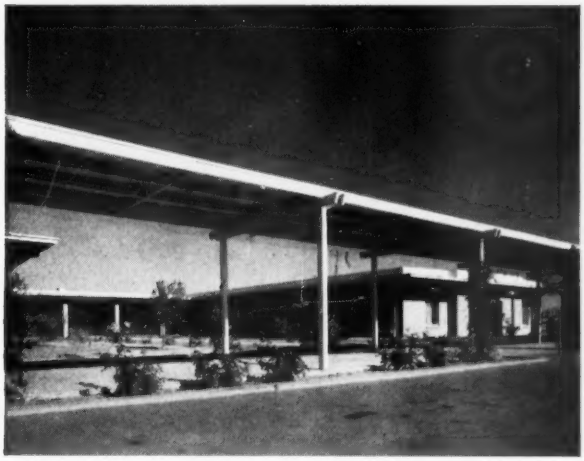
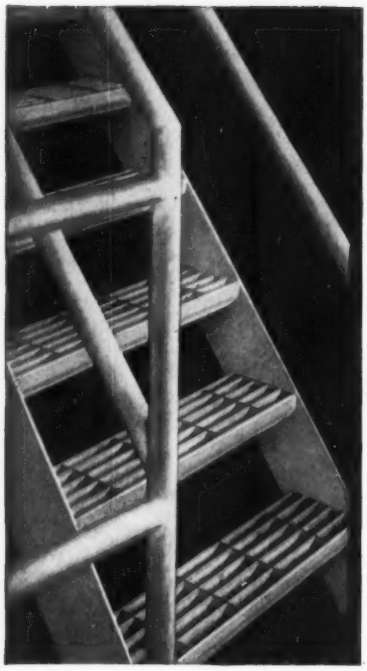


MODERN APPEARANCE of St. Luke's Hospital in Phoenix is matched by the modern performance of Westinghouse DS-3 transformers inside. This is only one of over 30,000 trouble-free installations of "virtually silent" Westinghouse dry-type transformers. Guaranteed quiet by sound testing every transformer in an ambient of 24 db.

Rigid conduit can be used for the DS-3, with no noise transmission from core and coils. Mr. G. C. Parker, Westinghouse representative, "sound tests" this unit, gets no reading above room ambient even with meter on transformer surface.



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SAFETY

Hendrick Shur-Site Treads have a non-slip surface that *insures* safety, making them the best choice for your stairs, ladders and fire-escapes. A heavy nosing bar provides reinforcement where the load is greatest. Shur-Site Treads are constructed by a pressure forming process, and so have no angle irons, bolts or rivets to collect dirt and refuse. Their 90% open area lets in plenty of light and air.

Shur-Site Treads are available in standard sizes or in special widths and lengths. They are shipped ready to bolt directly to stair stringers.

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Readers' Comment

Professional Aspects

Sir:

We have only had your magazine CONSULTING ENGINEER for a few months and already we find it one of the most valuable journals which enters our office.

We find it particularly valuable since it contains articles of a different nature than are available in any other journals. Those we particularly appreciate are:

¶ Those dealing with fees

¶ Those dealing with administrative and organizational problems

¶ Those presenting costs on special projects of an unusual nature.

¶ Those presenting better ideas for shortening the work and preparing better specifications.

We know of no Canadian magazine which provides comparable information, and we hope that you will continue to include us on your mailing list.

Ormond G. Moffat
O. G. Moffat Limited
Hamilton, Ontario, Canada

Serious Discrepancy

Sir:

I wish to call attention to an error in the April 1959 issue of CONSULTING ENGINEER. On page 80, in the section "Heard Around Headquarters," you have a heading "Surveyors Are Engineers." This is definitely not true and is not the findings of the ASCE task committee. The line should read "Surveying is Engineering."

These terms are not reciprocal for while a person may be qualified to practice surveying it does not follow that he is a qualified engineer, which is inferred by your erroneous terminology.

William Jay Sharpes, P.E.
Federal Electric Corporation
Paramus, New Jersey

Dealing With Architects

Sir:

Ever since I have been placed on the list to receive your magazine we have been reading it with a great deal of interest, and I must say that the information obtained has been quite helpful in several different situations.

Would it be possible for us to get a copy of the July 1958 edition? In the March 1959 edition, in the "Readers' Comment" section, there is a discussion of the split of fees between engineer and architect. This has been a problem with us and undoubtedly the article itself, "Dealing With the Architect Client," discusses other phases of the relationship which we would very much like to investigate.

N. E. Jennison
Jennison Engineering Inc.
Burlington, Vermont

On Unity

Sir:

In the May 1959 issue under "Heard Around Headquarters," in connection with your report on the NSPE Board Meeting, you state parenthetically that it would be necessary for NSPE to extend membership to

SAFETY IN THE RIGHT PERSPECTIVE

with Flexitallic Spiral-Wound Gaskets

In this enlarged sectional view, you can see the Spiral-Wound Gasket construction originated by Flexitallic in 1912. And you can see Flexitallic Blue, the blue dye in the Canadian asbestos filler, which is the mark of an engineered Flexitallic Gasket.

Flexitallic means sealing at its safest. You get performance you can depend on throughout all pressure/temperature ratings, because the compression characteristics of the gasket are always related to the pressure/temperature ratings of the flanges with which they are assembled.

When fluids are confined in a critical pressure/temperature range . . . when flanged joints are subject to thermal and mechanical shock, vibration, weaving, and other joint stresses . . . engineers demand the maximum in gasket performance.

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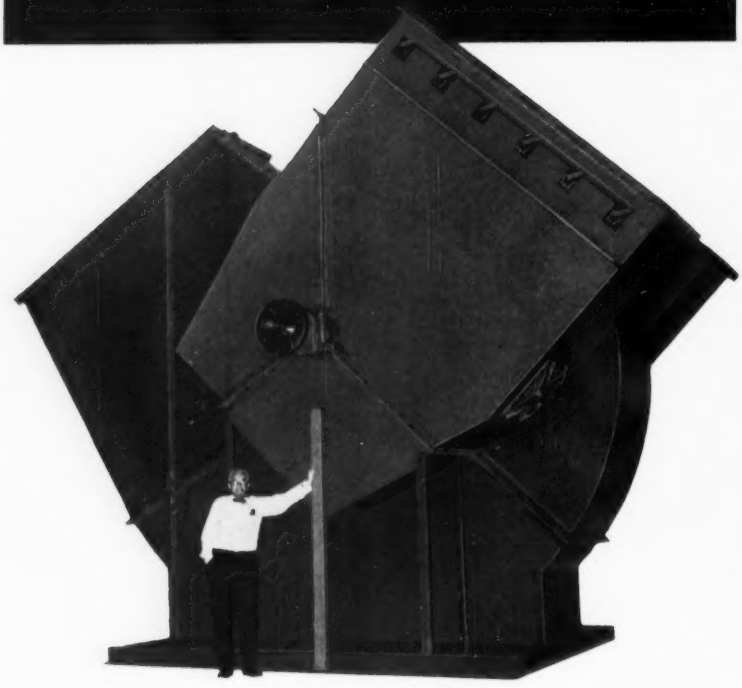
Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

Where Severe Applications are Standard



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This heavy duty WHIRLEX exhaust fan was custom designed for iron ore sintering machine. The unit is designed to carry hot gases at the rate of 200,000 CFM with 35 in. W.G. static pressure and is complete with scroll liner, cheek plate liner, blade wear pads, inlet louvre control dampers and removable section.

Additional facts and operating data on this and other WHIRLEX custom design fans are available at your request.

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nonregistered engineers under the AIEE Functional Plan. I believe that you should know that the AIEE Functional Plan does not include such a provision. There was a suggestion that NSPE consider such a possibility in order to expand its membership but it is not a part of the Plan.

There is enough confusion in the matter of unity already, and I suggest that you make a correction of your report.

George S. Rawlins, P.E.
National Director, NSPE
J. N. Pease and Company
Charlotte, N.C.

Broad Interest

Sir:

You have been doing a most wonderful job in publishing for us consulting engineers a most needed journal, which has helped me tremendously in my business as a young consultant. While it has been 25 years since college graduation, my shingle has been hung out only about five. Your articles on being a consultant, the reports on consulting practices throughout the world, the comparative studies of how other offices function, and the reports on CEC, CEAC, legislation, insurance, and legal points have all been wonderful for me. I am most grateful to you.

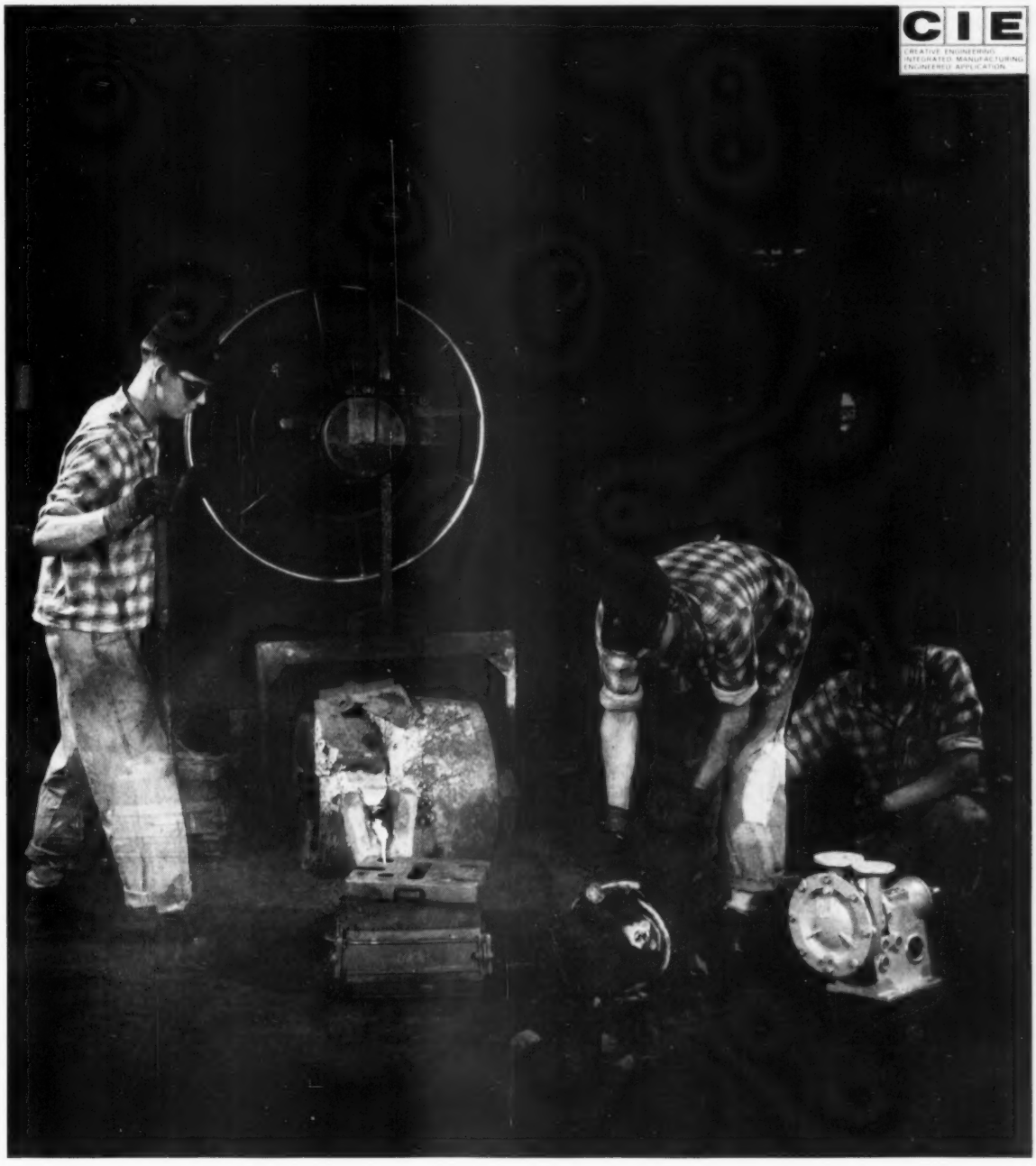
Francis E. Adams
Francis E. Adams & Associates
Los Gatos, California

Philosophy of Practice

Sir:

As the owner of one of the humblest engineering organizations in Canada I am pleased to let you know that I appreciate very much receiving CONSULTING ENGINEER. Since I have received my first issue, a year ago, I have gained a lot of confidence regarding the future of small consulting firms.

As you certainly know, it is often very difficult, when not impossible, for newcomers in some fields to determine the proper procedures to be adopted in the management of



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Result? You get a pump that's made to order for the job it must do.

Manufacturing pumps "from foundry to finish" also cuts costs. That's why you get a *better* pump from Goulds—made from high-quality, precision parts—at no greater cost than other pumps.

And, because it's not a mere assembly job, a Goulds pump can be designed and built for interchangeability —to cut your spare parts inventory and maintenance costs.

To completely control the production of our designs, we had to build the world's largest plant devoted to the manufacture of pumps exclusively. Over 100 years of experience gives us the know-how.

For help in solving *your* pumping problem, write to Goulds Pumps, Inc., Dept. CE-69, Seneca Falls, N.Y.

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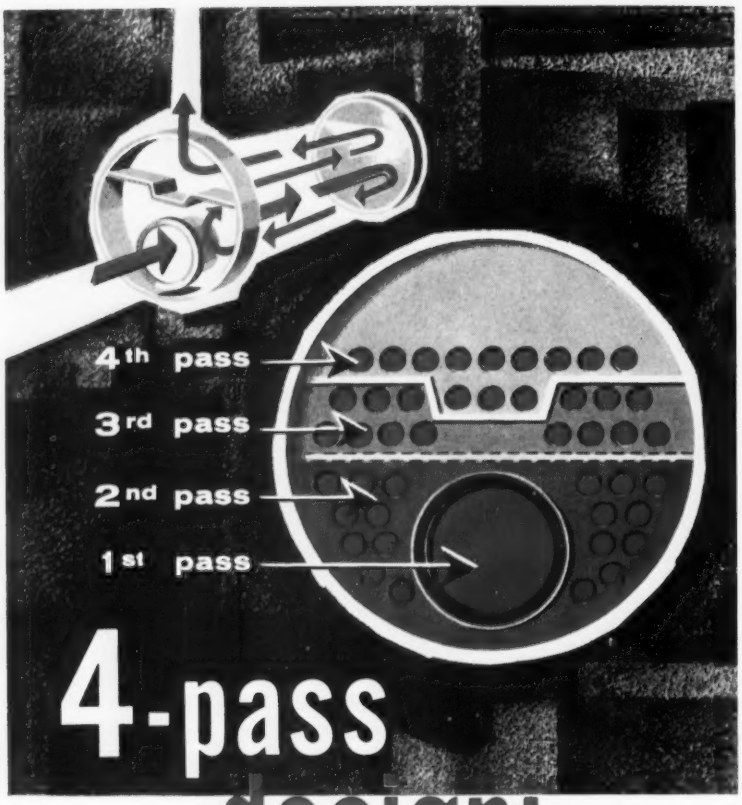

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High fuel-to-steam efficiency for greater fuel economy

EVERY CLEAVER-BROOKS boiler has 4-pass fire tube construction — to scrub more heat from the flame. Maintains high flue-gas velocity . . . to provide right conditions for optimum heat transfer. This is just one of the Four Design Standards that make pre-engineered Cleaver-Brooks boilers your best packaged-boiler buy.

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FORCED DRAFT supplies air for efficient combustion, regardless of draft conditions. Easiest to maintain of all air-control methods.

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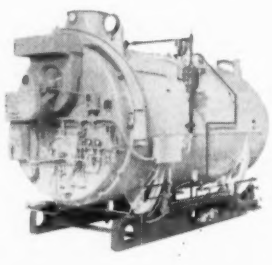
This exclusive combination of Design Standards is the key to the superiority of Cleaver-Brooks packaged boilers, 15 to 600 hp, 19 sizes, 130 models; steam or hot water; oil, gas or combination oil/gas fired.

For all the facts, call your boiler man from Cleaver-Brooks or write Cleaver-Brooks Company, Dept. G, 321 E. Keefe Ave., Milwaukee 12, Wisconsin.



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their organizations. Until now, the consulting engineer's unwritten laws of practice were somewhat hidden behind a condensed steam curtain that each consecutive issue of CONSULTING ENGINEER is helping to dissipate.

Along the lines of each article, and also between these lines, we discover viewpoints that will help us in forging a leading philosophy that will show us the way to better success in our private practice, our professional affairs, and above all, in the service of the community.

I am particularly pleased at the reading of the monthly biography of a leading consultant and also at the editorial dealing with very actual problems. I wish long and happy life to CONSULTING ENGINEER.

Rodolphe E. Phaneuf, Ing. P.
Montreal, Quebec, Canada

Will Do

Sir:

I have enjoyed reading your magazine for some time, as the opportunity presented itself — which wasn't too often because the copies were always "other peoples'!" Please help me to become a regular reader.

Theodore J. Kuehnert, P.E.
Senior Electrical Engineer
Sverdrup & Parcel Engineering Co.
St. Louis, Missouri

Error Noted

Sir:

We would like to call your attention to an error in the "New Projects Reported" section of the May 1959 issue. Under "City of Delray Beach" you reported "Sewage collection, transmission, and treatment (civil, structural, mechanical, electrical) $600,000. Client, Riviera Beach Sewer Company." This properly should have appeared under "Riviera Beach."

Under "City of Delray Beach" should have appeared "Storm drainage system. (civil, structural) $140,000. Client, City of Delray Beach."

Roy E. Weber
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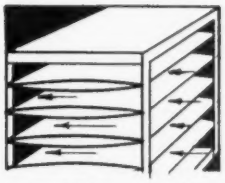
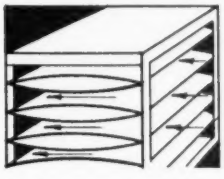
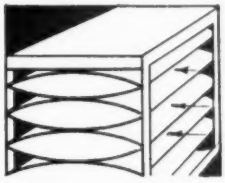
PNEUMAFOIL®



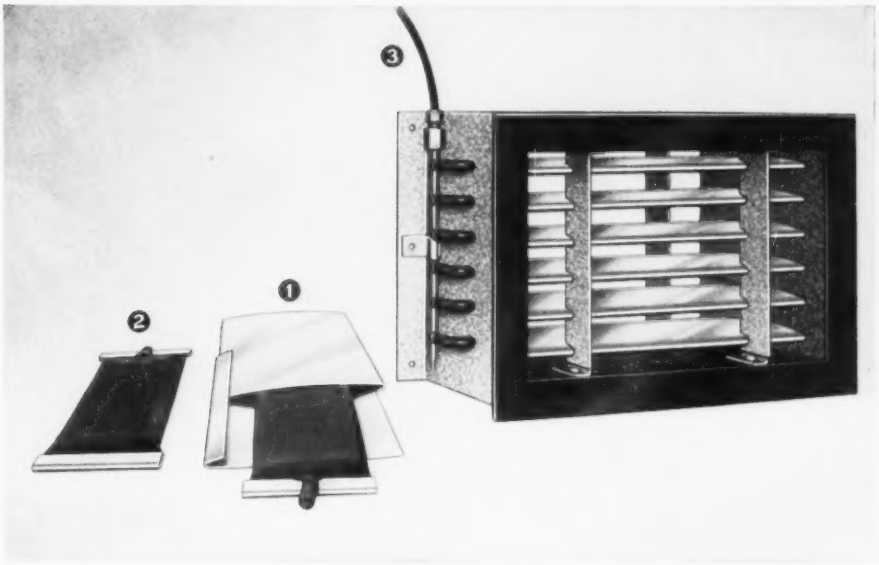
Pneumafoil has no linkage mechanism to actuate its vanes (1). Instead, each vane is occupied by a sealed neoprene actuator (2) connected to control air (3).



As air pressure is modulated between 0-15 psi, the actuator—literally lung-like in its pneumatic capacity—inflates, and expands the vanes; thereby producing throttling action by effectively diminishing the open area through which air can flow.



Achieving complete shutoff, all vanes make contact, allowing only negligible air leakage.



a pneumatically actuated high velocity air valve

PNEUMAFOIL is new in ways which are clearly beneficial to the design and function of a high velocity system, offering pronounced advantages of efficiency and economy over valves differently designed.

. . . new in DESIGN through which—for the first time—*pneumatic actuation* entirely eliminates the need for air motors and linkage mechanism in a rectangular high velocity air valve.

. . . new in CONSTRUCTION which employs streamlined air foil type aluminum vanes to minimize noise caused by air turbulence.

. . . new in CONTROL which is unprecedented in its operation directly by a standard pneumatic thermostat or constant volume regulator (both supplied by a 15 psi system).

. . . and extensive laboratory tests proved these Pneumafoil valves to have the incredible service life of twenty years!

DUAL DUCT SYSTEM ADAPTABILITY.

Available in 16 sizes, Pneumafoil also is the basic component in a new line of dual duct valve attenuators which range in air delivery from 1500 to 9600 cfm. Additionally, for fixed setting by manual adjustment, Connor offers MANUFOIL, which has a linkage mechanism and the same air flow characteristics of Pneumafoil.

For data on dimensions and capacities of this equipment, request Bulletin K-42.

Connor claims no corner on producing components of significantly advanced and beneficial design . . . but with Pneumafoil, Connor again demonstrates that its engineers constantly are developing equipment which assures the air conditioning industry and its customers of continued progress and growth.

CONNOR... for Constant Comfort Conditions

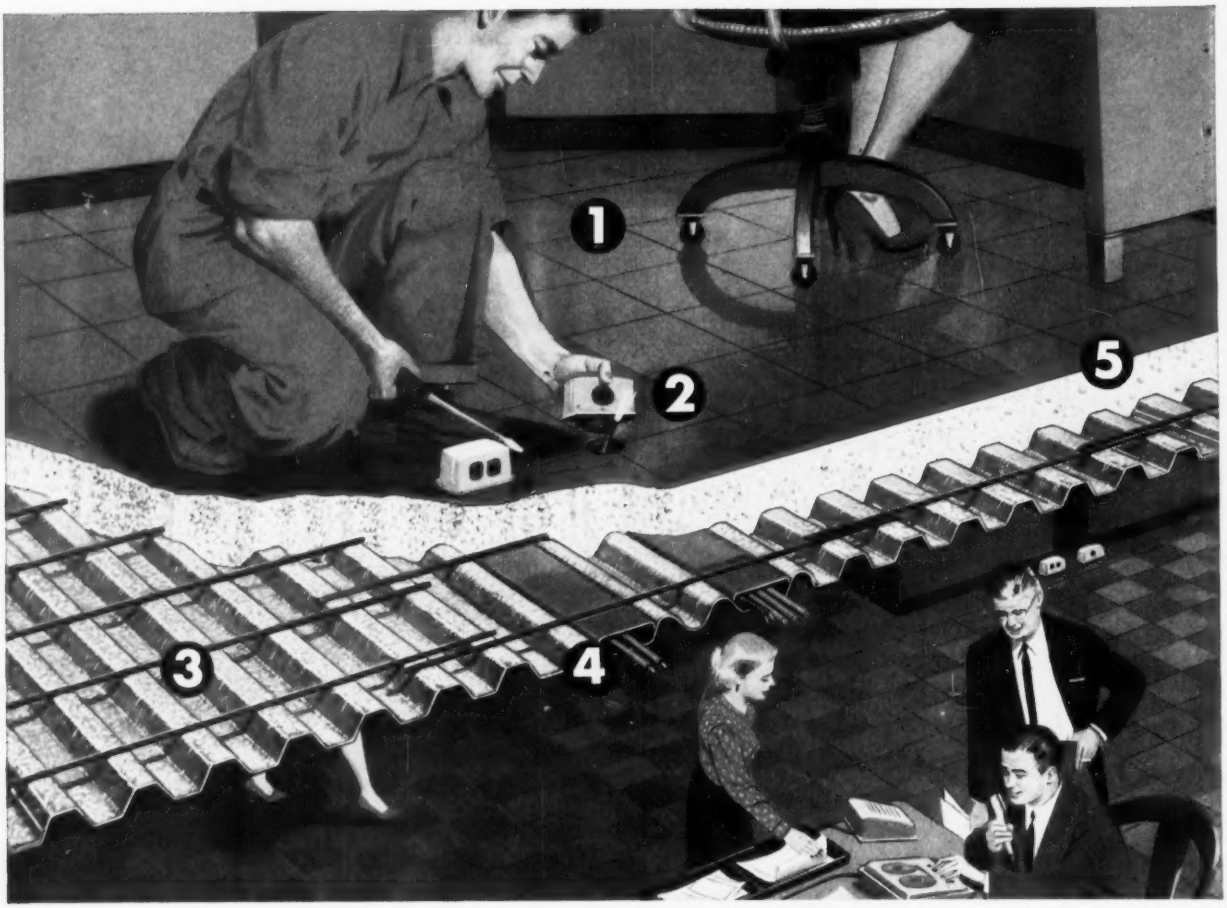
CONNOR ENGINEERING CORPORATION

DANBURY • CONNECTICUT

CONNOR ENGINEERING CORPORATION

kno·draft®

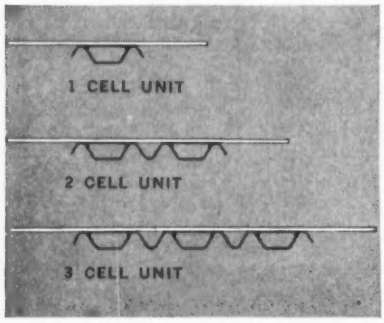
high velocity air diffusers



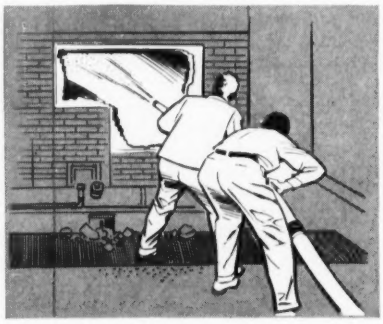
Reinforced concrete floors now

Cofar steel units provide both *form* and *reinforcement* for concrete floor slabs. Add special E/R (Electrically Ready) Cofar units to the system and, immediately, you satisfy the one remaining requirement of modern office floor construction—raceways for *complete electrification* to meet present and future needs.

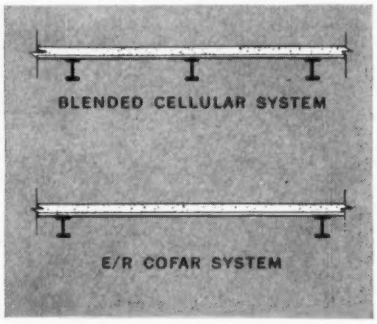
E/R units are wide troughs capped to form spacious cells for wiring. They are placed between standard Cofar units. Result: a solid, continuous base for concrete. Check these other features of the Cofar system:



ALL THE ELECTRIFICATION YOU NEED. By blending in one-, two-, or three-cell E/R units with standard Cofar sections you meet office electrical needs today and tomorrow.



FIRE RETARDANT. In a two-hour UL fire test, E/R Cofar became the first electrified cellular floor system (with header ducts and junction boxes in place) to earn a fire-retardant rating.



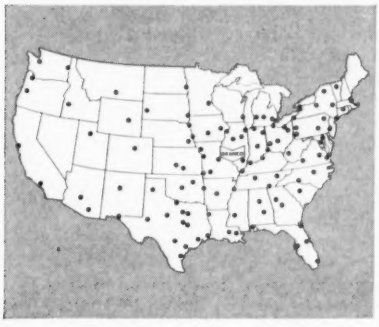
LESS FRAMING. Cofar reinforced concrete design permits wider spans, saves on structural framing costs, speeds up building completion and permits earlier occupancy by the owner.

1. **LOW-COST, HIGH-STRENGTH FLOOR** is made electrically flexible through the use of cellular E/R Cofar units.
2. **CLOSELY SPACED E/R CELLS** permit you to place outlets where desired, give building owners extra flexibility in positioning their office equipment.
3. **NO COMPLICATED FORMS** with Cofar! During construction, units serve as working platform and tight form for wet concrete.
4. **LARGE CELLS** (5.2 sq. in.) carry power, phone, signal circuits direct to desks and machines *anywhere* on the floor.
5. **NO WASTED FILL.** Cofar and concrete combine to give an intergated structural slab. No extra leveling fill is needed.
6. **AMPLE WIRING** through E/R Cofar units. Each cell can accommodate as many as 110 single-station phones, 19 six-key phones or 250 service outlets.
7. **PLACED ON ANY DESIRED CENTER,** E/R units can meet present and future electrical needs. Spacing of units is "tailored" to your individual job. No wasted cells!

fully electrified with E/R Cofar

- Effective span range up to 16 feet.
- Long-span construction means less framing.
- Less framing means less fireproofing.
- No wood forms to erect or remove.
- Optional pre-set inserts are available.

Other important advantages of the Cofar system are shown in the illustrations above and below. If you would like more information on Cofar and E/R Cofar details, design procedures and specifications, it's yours for the asking. Use coupon in lower right-hand corner.



COAST TO COAST. Cofar and E/R Cofar are available through more than 100 Granco distributors in the U. S. Granco also assures you fast, dependable delivery and helpful field assistance.

E/R COFAR

FROM THE GRANCO® FAMILY

FLOOR AND ROOF SYSTEMS FOR EVERY TYPE OF FRAMING

Granco Steel Products Company, 6506 N. Broadway, St. Louis 15, Missouri
A Subsidiary of GRANITE CITY STEEL COMPANY

MAIL FOR COFAR-E/R COFAR MANUAL
Just sign coupon . . . clip to your company letterhead . . . mail today. Att'n: Dept. C-93.

NAME _____

Our catalogs are filed in Sweets!

From the Editor's

Tranquil Tower

EARLY THIS SPRING the Consulting Engineers Council accepted an invitation to become a member of the International Federation of Consulting Engineers (FIDIC). There were only ten European Associations of Consulting Engineers affiliated in FIDIC until this year, when not only the United States but Canada, South Africa, and New South Wales were invited to join. Now it is an international federation in every sense.

Last year Edward J. Wolff, of Chicago, at that time president of CEC, was present at the Oslo General Meeting of FIDIC as an observer. This year he returns as a delegate to the meeting, which is being held in The Hague. Mr. Wolff will be able to discuss business and professional matters with independent consulting engineers of other nations, and he can bring back to the Consulting Engineers Council information concerning possible solutions to many problems of private practice – problems that know no national boundaries. This can be as valuable to the engineers of the United States as was the fortunate federation, three years ago, of ten separate state and regional associations into what is now the Consulting Engineers Council.

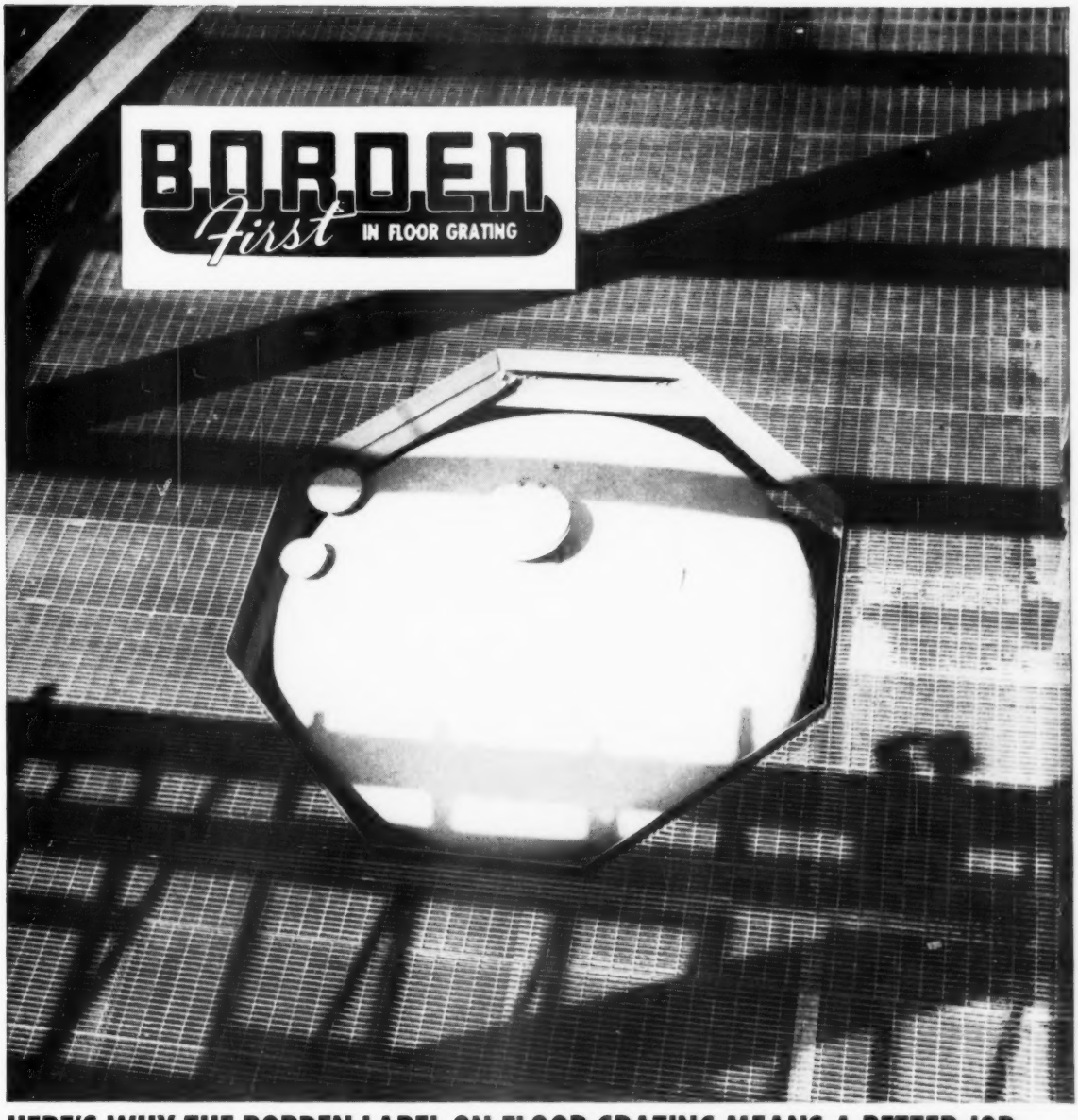
At the recent Annual Meeting of Consulting Engineers Council, in New York, the principal speaker at the banquet was Julian S. Tritton, of London, president of the International Federation. Mr. Tritton gave one of the finest addresses ever heard by consulting engineers. He opened the way for international cooperation on a scale never before imagined by engineers in private practice. His talk will be remembered as a major milestone in the progress of the profession.

The affiliation of the Council with FIDIC automatically brought about a solution to a growing problem in this hemisphere. There have been many demands for some sort of cooperative solution to mutual U.S.-Canadian problems of private practice, yet there never before had been any direct contact between the Association of Consulting Engineers of Canada and the Consulting Engineers Council. Now, with both in FIDIC, there is a way to work together as members of the same organization. In this connection it is interesting to note that Mr. C. C. Parker, president of the Canadian Association, was present at the Council meeting in New York, and he invited the new president of CEC Ralph Westcott, or his representative, to attend the Annual Meeting of the Canadian Association in June. This new tie between Canada and the U.S. alone makes membership in FIDIC worthwhile.

The FIDIC annual meeting in The Hague is scheduled for May 28 and 29, shortly after this issue of CONSULTING ENGINEER goes into the mails. We will be in The Hague at that time, and we will have an opportunity to find out how a FIDIC meeting works, the type of problems they try to solve, and the approach they use. In the July issue of CONSULTING ENGINEER we will be able to tell you about that meeting and its accomplishments.

Officers of FIDIC are elected for four years, and the current officers, with the exception of Dr. Werner Zeller, of Stuttgart, Germany, all have agreed to serve for another term, if reelected by the member associations at the general meeting. Dr. P. Walter, of Essen, Germany, probably will assume the office left open by the resignation of Dr. Zeller.

This means that FIDIC will be, for the next four years, in excellent hands. Tritton, of England, will continue his fine work as president; Bory of France will remain vice president; while Rusting, of The Netherlands, will still be secretary. The treasurer is Schubiger, of Switzerland, while Mr. Hylland, of Norway, and Dr. Walter will fill out the executive committee. No better group of men could be found. We wish them every success in the four years ahead, in fulfilling their duties as officers and executive committee members in this growing international organization. ▲▲



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You cut installation cost . . . Borden Checking Service insures correct dimensions, fit and placement — each panel checked for size, each panel marked, and entire platform is laid out on our shop floor and checked against the shop drawing.

Level, even surfaces . . . Floor gratings and safety steps by Borden insure easy working, walking and wheeling surfaces because our precision manufacturing processes require finest quality materials and workmanship.

Free from warps or camber . . . Factory tested and inspected, Borden gratings stay perfect through the uniformity of materials and design. No imperfections or irregularities of construction to cause warping or camber, trouble-free service assured for the life of the gratings.

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16-page catalog showing all basic types of grating; more than 30 dimensional drawings of subtypes; eight safe load tables for steel and aluminum grating.

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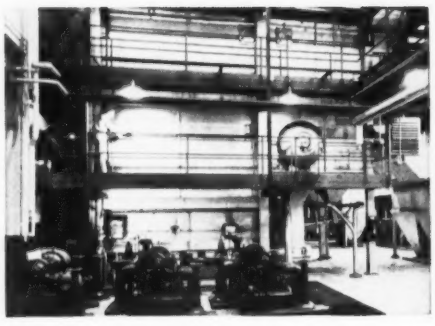
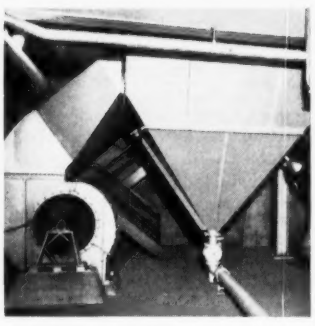
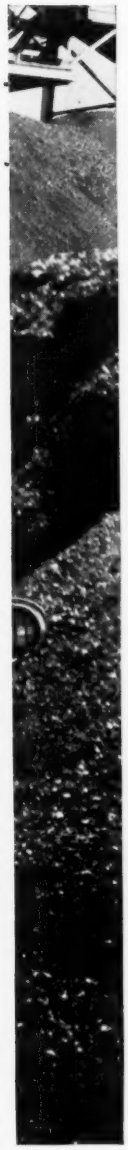


Steam generating plant at Morton, Ill. plant uses two 60,000 lb/hr Wickes boilers, 3 stories high. These are equipped with Hoffman continuous ash-discharge spreader stokers.

Track unloading hopper at York plant. Coal feeds from belt conveyor to bucket conveyor to distributing flight conveyor over storage bunker. Coal handling system by Beaumont Birch.



Ash hopper in Decatur plant. Pneumatic ash removal system by Beaumont Birch Co. connects to vitrified tile ash bin and rotary dustless unloader.



Caterpillar makes tracks for coal

Seven Caterpillar Tractor Co. plants burn coal for low-cost steam generation

When seven plants of a company all burn coal —over 250,000 tons a year—you can be sure there's a *good* reason. At Caterpillar Tractor Co., where steam is used for both process work and heating, coal is burned for low-cost, efficient steam production.

Because of its importance at Caterpillar, steam generation must meet the same standards of efficiency and dependability set up for all phases of plant production. As Caterpillar has expanded from one plant to many, therefore, *each* plant has burned coal.

Coal is lowest cost fuel

Today, *when the annual cost of fuel often equals the original cost of the boilers,* you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% *more* steam per dollar, while automatic operation trims labor costs and eliminates smoke problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

Technical advisory service

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project in the works, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require to facilitate the job.

Send for FREE booklet

Meanwhile, we believe you will be interested in our informative case histories booklet, complete with data sheets. Send coupon below for your copy . . . or for any other available BCI publications.

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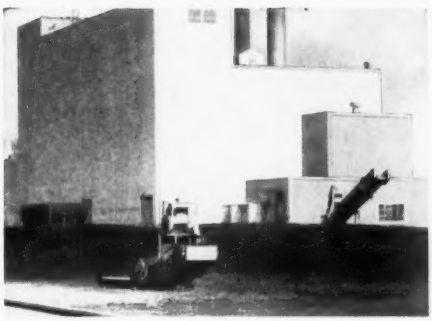
See our listing in *Sweet's*



Exterior view of steam plant at Joliet, Ill. Foreground shows part of outside coal storage area featuring portable car unloader and stacker. Coal is stocked out and reclaimed by Caterpillar bulldozer-equipped crawler tractor.

SEND COUPON FOR NEW BCI PUBLICATIONS. Guide Specifications, with complete equipment criteria and boiler room plans:

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☐ GS-1 (low-pressure heating plant, screw-type underfeed stoker); ☐ GS-2 (high-pressure heating and/or process plant, ram-type underfeed stoker); ☐ GS-3 (automatic package boiler for heating and process plants). ☐ Case histories on larger plants.

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The Readers' Guide

Food For Thought

(page 80)

Often in our publication of the Reports of the Committee of One-Hundred, we have told the manufacturers and suppliers what consulting engineers think is wrong with the way they do business. Now, we have given the manufacturers a chance to tell their side of the story. In the article, "What's Wrong With Consulting Engineers?," 200 manufacturers and their representatives have expressed opinions concerning consulting engineers and the way they practice. It must be kept in mind that we asked only for comments on malpractice. We did not ask for compliments or bouquets. Still, almost every answer stated that the criticisms were directed at only a few consulting engineers; that the great majority were professional men with whom it was a pleasure to deal. We publish this article to show consulting engineers some rotten spots; some worms in the fruit. Only by knowing our faults can we eliminate them, and they must be corrected before the private practice of engineering will come of age as a profession.

Fire Hazards of Wiring

(page 110)

About five years ago we published a series of articles that proved to be, in reprint, our most often requested article. It was "The Consulting Engineer as an Expert Witness," by Robin Beach. Now, Mr. Beach has written another article for us, on an entirely different subject, but one that we predict will also be well read and frequently reprinted. It is "Arsonist on the Premises," which tells about the fire hazards of incorrectly installed or overage flexible armored electric cable. As Mr. Beach points out, this flexible cable is a convenient, inexpensive, and perfectly safe type of wiring for small industries, commercial buildings, and homes. But its installation must be intelligently planned and supervised, and the engineer must make sure that it will be properly used and maintained. Otherwise, it is a serious fire hazard. The article includes valuable original nomographs.

Shopping Center Economics

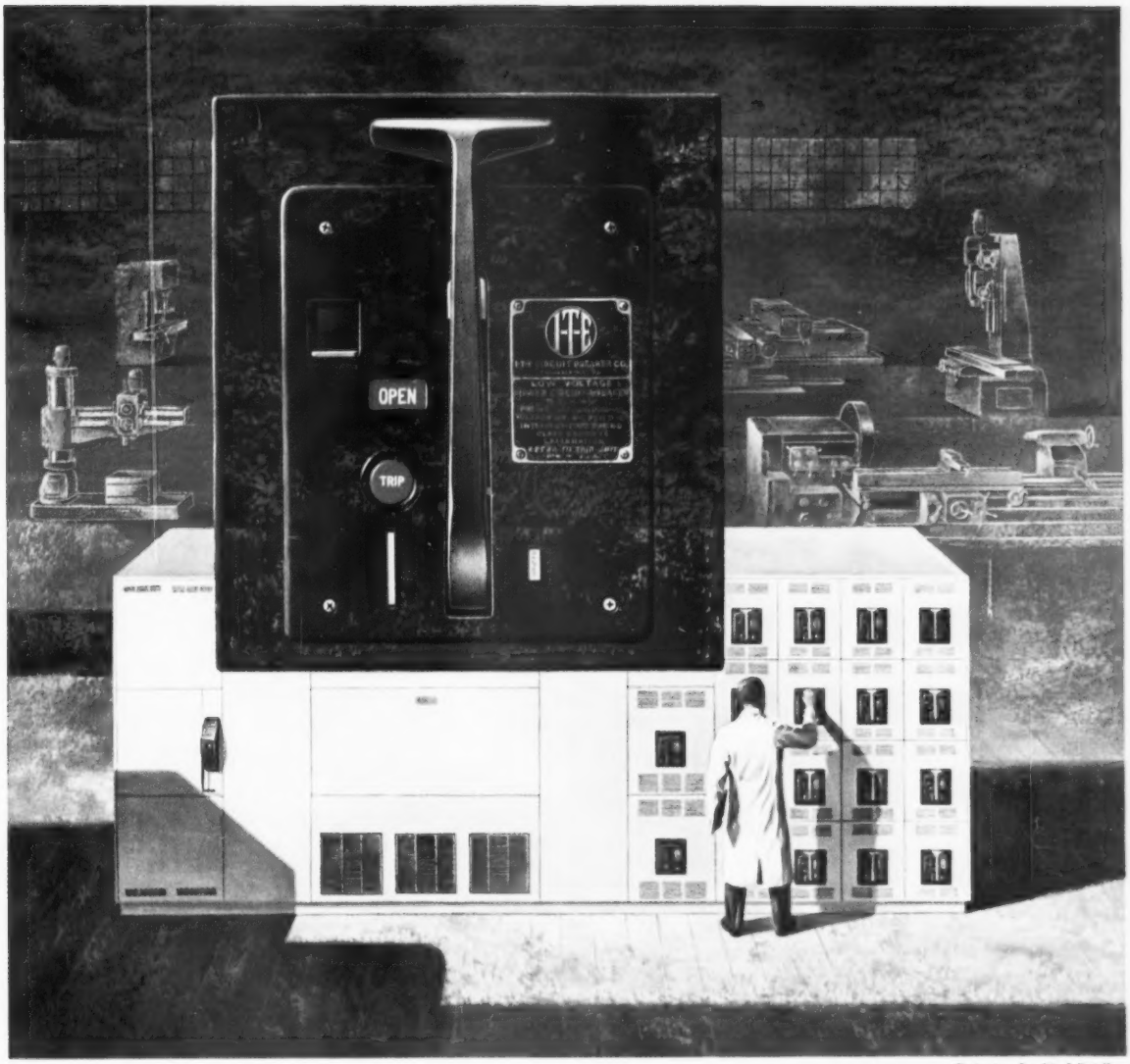
(page 104)

The financier of a proposed shopping center is much like any other client in that he has a tendency to wait until the last minute before he calls in a consulting engineer. He knows an engineer is needed in the design stage, but he often forgets that the engineer could be of value long before the site is selected. Many consulting engineer firms are offering clients a full service that guides from conception through supervision of construction, and it involves not only site selection and design but also market studies, contacts with prospective leasees, and financial negotiations with lending agencies. Arthur M. Sells II, of Radar and Associates, tells about his firm's approach in his article "Engineering Is More Than Design — On Shopping Center Projects." You will find that this article suggests many ways in which a consulting engineer can more fully serve his client.

Great Books of Engineering

(page 94)

Many modern textbooks are actually a compilation, rearrangement, and rewriting of the great discoveries of engineers and scientists through the ages. In almost every instance, the discoverers of technological truths wrote of their findings. Some of their writings have been lost and some have been distorted in translation, but much remains of many important original works. It is unfortunate that engineering students do not have time to study the writings of Hero, Vitruvius, and Frontinus, among the ancients; Alberti and Agricola, of the middle ages; or Rennie, Rankin, or Stephenson, of the 19th century. With the thought that many of our readers would like to know what these great engineers said, in their own words, we asked James Kip Finch, Dean Emeritus and Renwick Professor of Civil Engineering, Columbia University, to select passages from the great engineering books of the ages, and add his own explanatory comments. This month, Dean Finch starts his series with the Rhind Papyrus, the first of all engineering works, written about 1500 B.C. (in itself not suited to direct excerption).



Painting by Ned Seidler

FACT

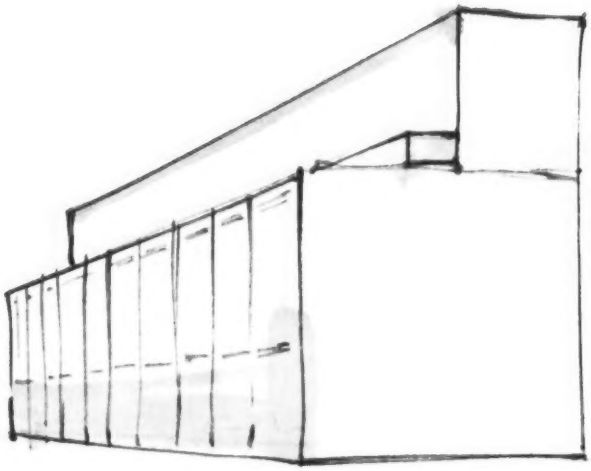
A dollar allocated for electrical equipment is worth more . . . when it is used to buy I-T-E equipment. Because I-T-E's policy is to build its equipment better, and yet charge no more.

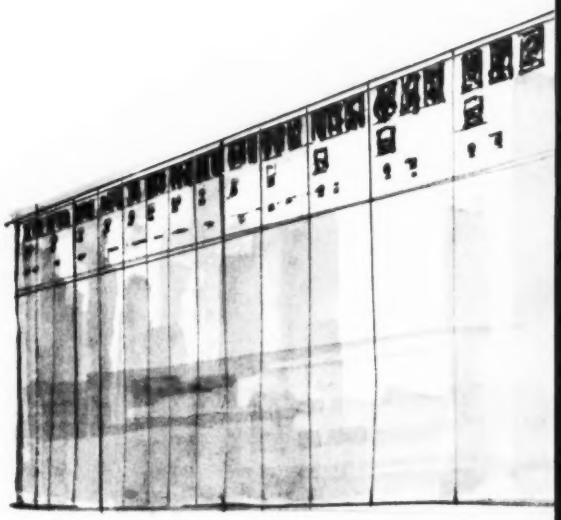
Take a typical secondary unit substation, for example. It features the new K-LINE circuit breakers . . . today's most advanced line. They stack four high in ratings up to 600 amp . . . save roughly ⅓ the space and half the weight formerly required. Circuit breaker pulldown handle with stored energy mechanism gives quick-make closure that means greater operator safety and longer contact life. The breaker can be drawn out to disconnect position without opening the door. And if the load increases later, expanded range trip devices adjust quickly and without added expense.

These features add up to real dollars and cents savings over the life of the equipment. Yet they cost nothing extra. In addition, I-T-E substations are engineered and manufactured in a single I-T-E plant for extra installation ease and better performance.

There are other I-T-E facts too. Turn page.

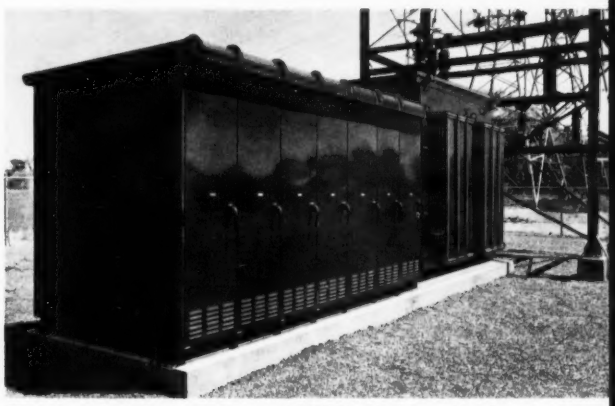
I-T-E CIRCUIT BREAKER COMPANY



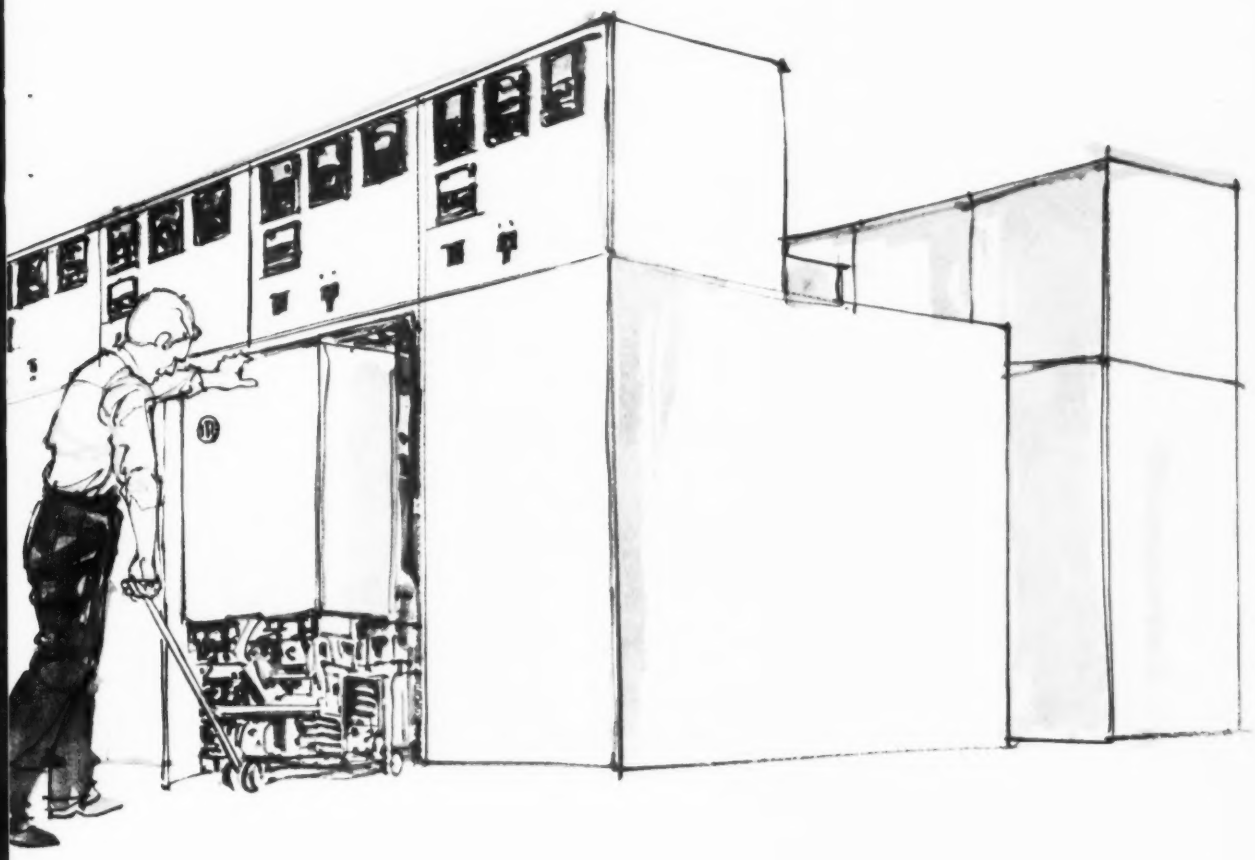


WHERE ELECTRICITY GOES I-T-E GOES

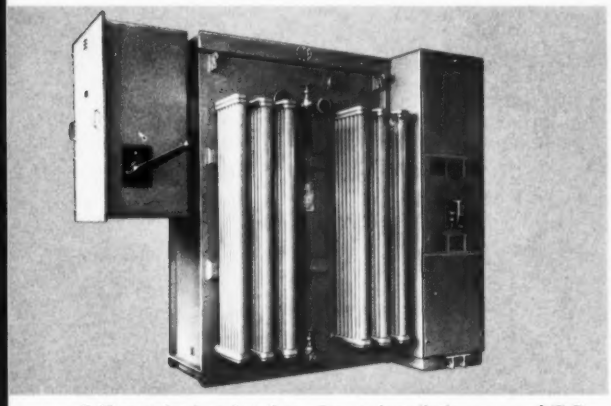
Are you fully acquainted with the broad I-T-E line . . . and the many ways it can help your dollars buy more?



Custom designed at no extra cost. I-T-E primary unit substations are designed and built to meet the specified power, space and future expansion requirements of the particular installation for which they're ordered. In addition to standard outdoor metal-clad construction, weatherproof walk-in switchgear is also available. Transformer and switchgear sections are constructed in the same plant to assure smooth coordination of components, easier assembly, pretested performance, and on-time delivery.

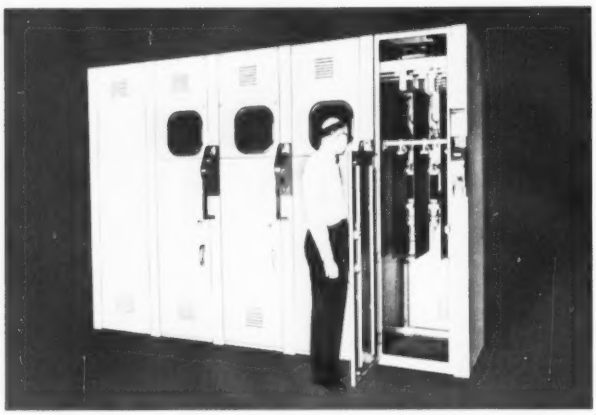


Protection for primary power. I-T-E metal-clad switchgear has many extra advantages not available elsewhere. Take a good close look. You'll find extra sturdiness that means extra serviceability. And extra craftsmanship that gives the owner a feeling of pride. For easy inspection, even the rear doors are hinged, and components are completely accessible. All essential circuit breaker components are mounted on the breaker for easier access. Uniform flux density magnetic arc field means superior protection . . . especially against high current faults. For extra safety, breakers stop automatically in test position when they're rolled into the compartments. They can't be moved into or out of connected position unless they're open.

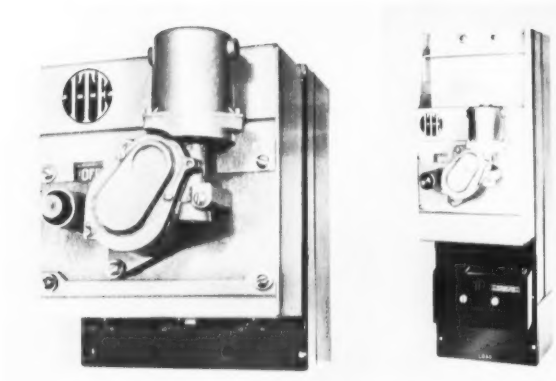


Self-contained substation. Saves installation cost. I-T-E TRANFO-UNIT combines primary disconnect, transformer and secondary circuit breakers all in one package. Nothing else to buy. Simplifies ordering. Delivered complete. Installation time and cost reduced to an absolute minimum. No complicated assembly of separate parts. Gives neat appearance. Completely safe. No live components open to contact by personnel. Needs no fence. Use for incoming power up to 3000 kva. Or spot near load areas in large plants.

600 volt value package. New URELITE® individually enclosed I-T-E K-LINE circuit breaker is ideal for single circuit protection and control, such as large motors and other heavy loads or for service entrance on many commercial-type buildings. Main disconnect contacts are visible through a side window for extra safety. Features quick-make closure, closed door disconnect, and expanded range trip device. Available in capacities from 15 to 1600 amp continuous, up to 75,000 amp interrupting.



Economical primary switching. I-T-E power switching centers save cost and time. Give dependable fused protection at low initial investment. Building block design speeds delivery. Preassembled units easy to install. Performance-proved I-T-E switches close safely into fault. Available for remote or automatic control. Up to 14.4 kv and 1200 amp.



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- ☐ TRANFO-UNITS
- ☐ Power switching centers
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Company.....

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The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

The Law of Real Property: Dedication of Land

DEDICATION is the term employed in the law of real property to signify the appropriation of land to public use. The essence of dedication is that the appropriation be for the use of the public at large, rather than for any particular portion of the public. However, it may be dedicated for a special public use, such as a highway.

Common Law Dedication

At the common law, the only requirements for a valid dedication are an intention to dedicate, and use by the public. It frequently is made by deed, but there is actually no requirement that there be any writing, provided the intention to dedicate is shown sufficiently. For example, an intention to dedicate may be shown if the owner has assisted in the improvement of the land to adopt it for public use. This is an exception to the general rule of conveyances of land, which require a deed in all other examples of intentional transfer of title.

Dedication also is unusual in another important respect – there need be no individual who owns the land dedicated to public use. It is not necessary, for example, that title be conveyed to a municipality, although sometimes it may be. The land is essentially "in the public domain," owned by the public at large, rather than by any particular individual or legal entity.

The historical origin of this unusual doctrine of real property law has ancient roots in England, and it was based on the idea of customary rights exercised by the public. In the United States, it is based on the idea of estoppel. Where the owner of the land has allowed the public at large to use the land for a considerable length of time, he tacitly represents that the public has the right to continue to do so indefinitely, and he will not be permitted to deny this.

In some states, the idea of estoppel is made explicit by statute. For example, a Michigan statute provides that the use of land for a highway for 10 years or more conclusively establishes the dedication of the land for that public use, even though there be no proof that the owner so intended.

Statutory Dedication

In addition to dedication of land under the common law, statutes now provide another mode of dedication of land. Under this procedure, a plat or map is made by the owner, showing the land to be dedicated for public use. It then is acknowledged and recorded with the registrar of deeds. Such recording constitutes an offer to dedicate, which becomes a binding dedication upon acceptance by the public. The acceptance may, in general, be either by public use or by an act of an appropriate public authority (e.g., approval by a township board of a recorded plat or their exercising authority over the

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A SWEET STORY

1. "Odor is our big problem," said Fred. "Our dog has a strong smell.
2. "So has our parrot," said Henry.
3. "I have an idea," said Fred. "A man at the zoo has a black box, shaped like a can, which blows air through it rapidly. It's great. It takes out all odors, better than anything."
4. "What is in the can?" asked the dog.
5. "Activated charcoal," said the parrot.

If you have a parrot, teach him to suggest the use of activated charcoal filters for odor removal in critical environments, and for important money savings in air conditioning, through recirculation of inside air. Ask for Bulletin T333. Send your parrot's name and address to Barnebey-Cheney Company, Columbus 19, Ohio.

Barnebey Cheney

*We gratefully acknowledge American Book Company's permission to use the illustration, and tip our hats to McGuffey whose First Reader is more than 100 years old.

property by improving it for public use). Use by the public constitutes acceptance, provided it is sufficiently general and long in duration. The use also must be of such a nature as to be inconsistent with private ownership of the property.

In general, the acceptance must come before the offer is withdrawn, and within a reasonable time.

Limitations

If a dedication is made for a specific purpose, the public's use is limited to that purpose.

Public rights in dedicated land may be lost by abandonment. Abandonment may occur by nonuse or misuse of the property. However, what is required, in order that the property should revert back to the grantor, is not merely nonuse or misuse, but nonuse or misuse of such a nature as to amount to abandonment. Abandonment is actually a question of intention.

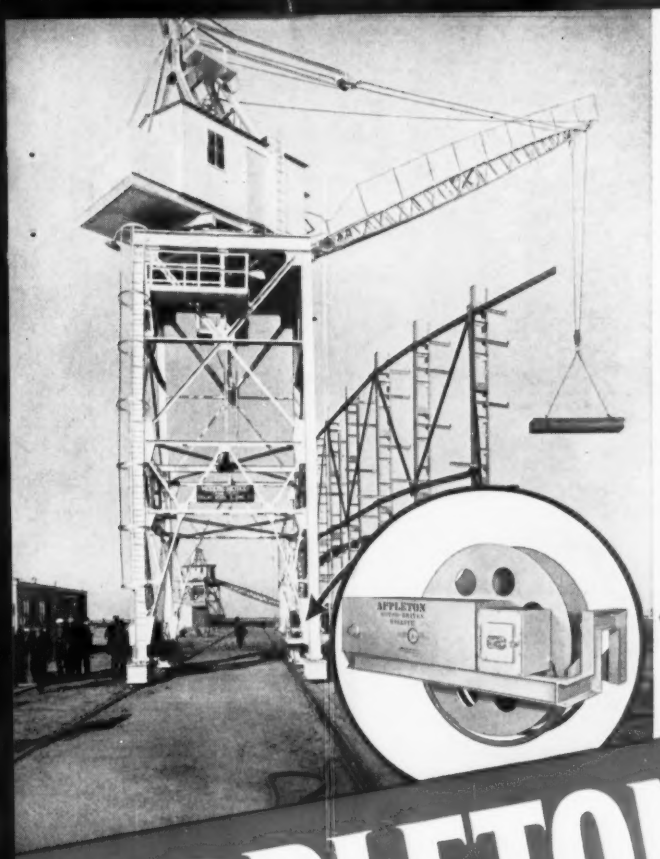
If a public authority sells the dedicated land to a private individual and thereby cuts off the right of the public to use the land, this generally will be held to be an abandonment, and the property will revert back to the original owner, instead of going to the purchaser.

Any use which is inconsistent with or substantially interferes with the purpose for which the land was dedicated constitutes a misuse or diversion of the property. Such a misuse, if persisted in sufficiently to show an intention to use the property in a manner contrary to the purpose for which it was dedicated, will amount to abandonment. The property then will revert back to the grantor.

An Example

The case of Village of Maxwell vs. Booth, 73 N.W. (2d) 177, a Nebraska case decided November 25, 1955, is an illustrative example.

In 1909, the owner of certain land filed a plat showing four blocks with streets around each block, and with alleys through each block. The streets and alleys



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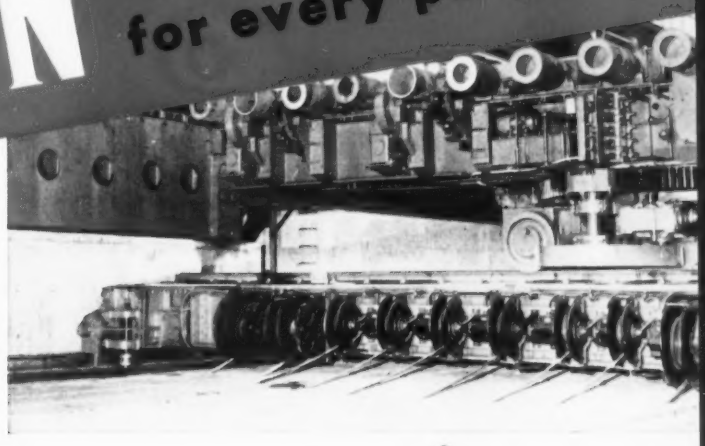

Installation using a custom built Type "EG" constant duty automatic take-up *Reelite* for unloading steel from gondola cars

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were marked "dedicated to the Public use."

Subsequent Events

A portion of the streets never has been graded or maintained as a street, and is unused and unimproved so far as public travel is concerned. However, in 1932, the Village granted a telephone company the right to construct and maintain telephone lines through these streets, and the installation included the unimproved section. In 1951, a drainage ditch also was constructed along this "street."

In 1953, the present owner of the land, Booth, began to build a garage in the designated "street" and completed it over the protest of the Village. He also built a house, whose west wall and eaves are in the "street," and he built a fence across the "alley."

The Village then brought an action asserting its ownership and right of possession of the "street," and adopted a resolution to open the "street." Booth defended on the ground that the Village had never accepted the dedication offer, and that he had revoked it.

Court Decision

The court held that the plat is an offer to dedicate, which then must be accepted before dedication becomes complete. However, it is not necessary that the Village actually open it as a street for public use, in order to constitute acceptance. Any positive conduct of the public authorities evincing their consent will suffice. Granting rights to the telephone company was an acceptance. So was the actual use of the "streets" for the telephone lines, and so was the construction of the drainage ditch. Acceptance also was shown by the protest by the Board of Trustees to the erection of the garage, and by adoption of the resolution to open the street.

Therefore, the land was held to be dedicated to the public use, and the offer to dedicate it could not be revoked. ▲▲

This Armco Corrugated Metal Pipe, after assembly on the stream bank, is now ready for lifting with a crane and swinging into position.

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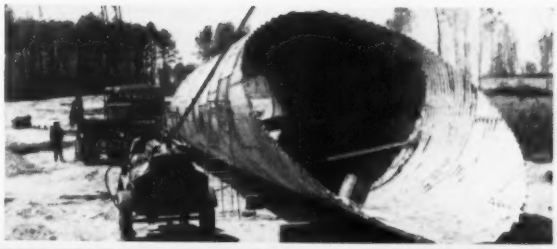

View of skewed end of the same Armco MULTI-PLATE Pipe, installed near Speight's Run Dam, that saved money for Portsmouth, Va. Pipe has been coated with asphalt.

"Armco MULTI-PLATE Pipe helped City of Portsmouth save $5,000"

So said Mr. X. D. Murden, Superintendent of the Water Department, Portsmouth, Virginia.

He was referring to an installation of Armco MULTI-PLATE® Pipe, 13 feet in diameter and 70 feet long, used in place of a conventional bridge in connection with a dam built to supply water for Portsmouth.

Original plans called for a steel beam bridge with concrete deck and abutments supported on timber piling. But after test piles were driven to unexpected depths, it was realized cost would be much more than planned. So the MULTI-PLATE Pipe was proposed by the engineers to effect considerable savings.

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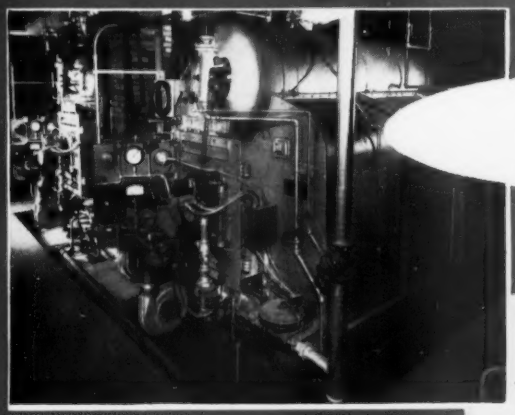

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[illegible]
Rochester, Pennsylvania
2 — 150 h.p. Keystone Steam
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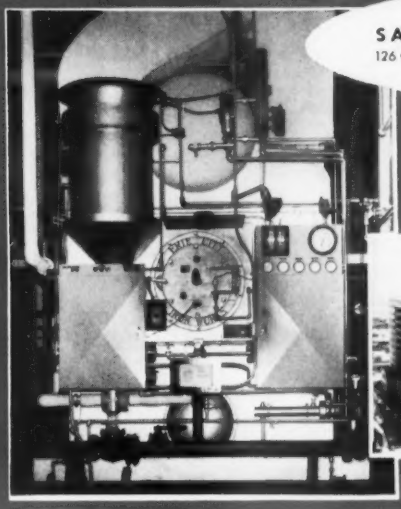
Architect — [illegible]
New Brighton, Pennsylvania



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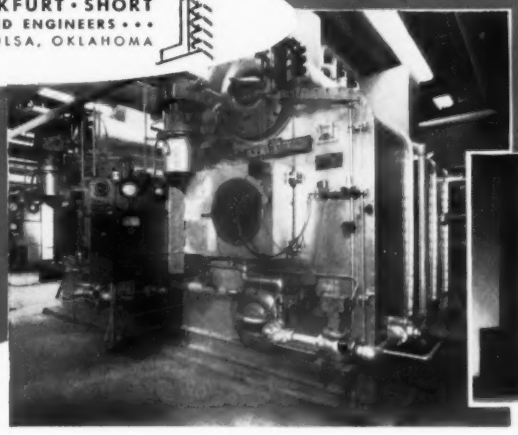
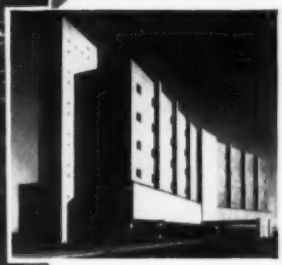
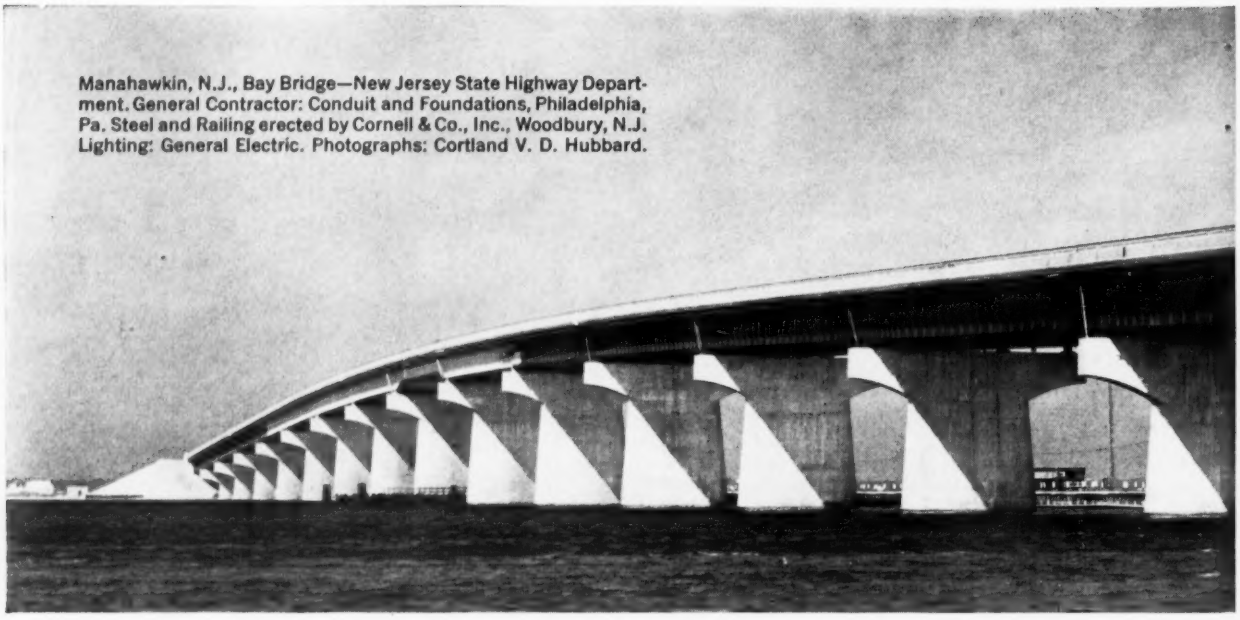


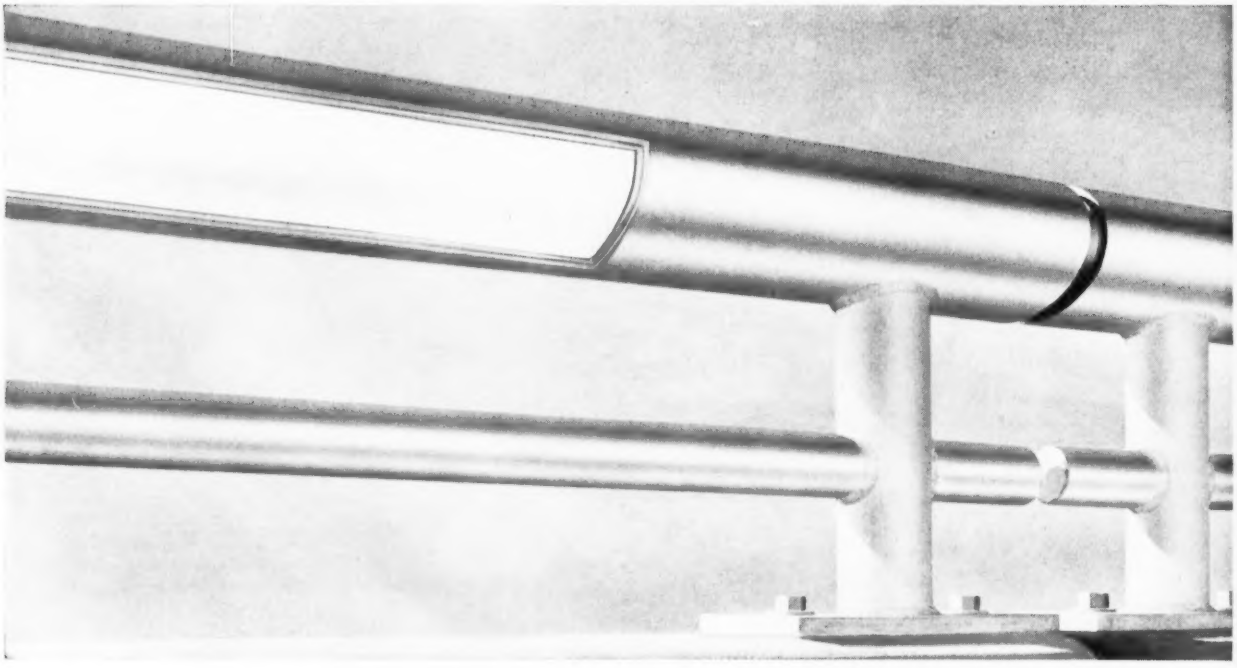
Baptist Memorial Hospital
Oklahoma City, Oklahoma
2 — [illegible] h.p. Keystone Steam
Generators, Gas Fired





Manahawkin, N.J., Bay Bridge—New Jersey State Highway Department. General Contractor: Conduit and Foundations, Philadelphia, Pa. Steel and Railing erected by Cornell & Co., Inc., Woodbury, N.J. Lighting: General Electric. Photographs: Cortland V. D. Hubbard.

2400 FEET OF BRIDGE . . . 4800



To provide for luminaire lighting, the engineers of Manahawkin, N. J., Bay Bridge—in conjunction with General Electric—worked out the special design for the bridge railing shown above.

And Michael Flynn—in strict accordance with specifications—supplied the extruded aluminum railings, posts, and base plates. Later these were welded into easily manageable units which could be handled and installed with minimum labor.

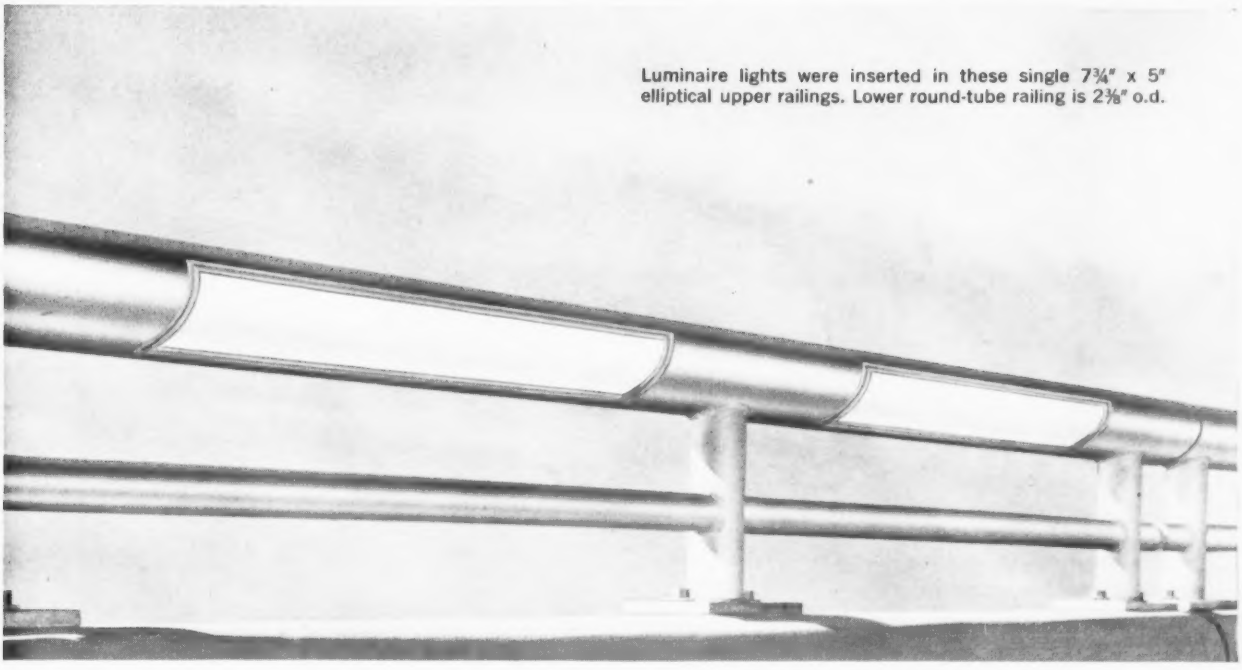
The ability to turn out material for special designs is one advantage Flynn offers you. For many jobs, however, where post and rail jobs are desired, you can save money by choosing from Flynn's great variety of functional, attractive *standard* designs.

Also you can depend on Flynn to deliver aluminum railing and components direct to the job site, ready for fast, easy installation . . . on time, in the quantities specified.

What's more, no overmanned crews, no lift trucks, no cranes are needed on Flynn installations. Two men, with wrenches as their principal tools, can install the lightweight Flynn bridge railings shown here. (With other Flynn railings, one man can often do the job alone.)

And because Flynn bridge railing is non-rusting aluminum, it never needs painting. It's so tough and durable, nothing short of an accident can make replacement necessary.

FEET OF FLYNN BRIDGE RAILING



Luminaire lights were inserted in these single 7¾" x 5" elliptical upper railings. Lower round-tube railing is 2⅜" o.d.

For help in your own projects, send for a free copy of Flynn's new bridge railing catalog. Write on your own letterhead to Michael Flynn Manufacturing Company's main office.

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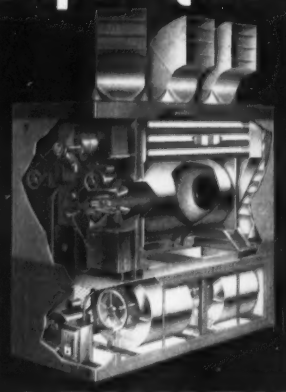

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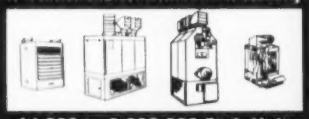

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RALPH S. TORGERSON
West Coast Editorial Representative

Report from the West Coast

ARIZONA — the last of the territories within the continental United States to become a state (1912), and still one of the less populated states — has experienced phenomenal growth in the past 10 years. Population has doubled, and of more importance to consulting engineers, building construction permits have almost tripled. Arizona also leads the nation in rate of income growth and agricultural income growth.

The economy of the state is largely based on agriculture and mining, though Arizona also derives a large income from tourists. There is practically no heavy industry, but considerable light industry has been attracted to the state, especially in electronics. This situation should continue, for the state has not sought heavy industry and even has ruled out any industry which might detract from the scenic and climate advantages of the state.

About half the population lives in Maricopa County, with Phoenix, the capital (390,000) and its satellite cities accounting for over 500,-

Johannessen and Girand designed the Sky Harbor Airport at Phoenix, Arizona.

Disastrous mid-air collisions and harrowing "near misses" between aircraft in the nation's crowded skies may one day be rare. Federal Aviation Agency and Congress are rushing a whole new system of air-traffic control which will eventually put nearly all military and civilian planes, in good weather or bad, under control of ground centers using radar, computers and other devices.

White Superior 40-SX-8 diesels have already been purchased for many of these control stations. These dependable 600 KW generator sets will supply automatic standby power, ready to prove in an instant their reputation for quick, easy starting and continuous, reliable operation. Ready to demonstrate, too, that precision construction provides long, trouble-free performance with low maintenance and maximum fuel economy.

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- Because, over the past 67 years, long-lasting, trouble-free service has proven the DEPENDABILITY of Fairbanks Valves to the nation's leading consulting engineers, architects and contractors who have specified and installed these valves in the systems for which they were responsible. This acceptance of Fairbanks Valves is demonstrated by the fact that in over 50% of the new building construction described in an ENGINEERING NEWS-RECORD article "Office Building Boom Alters New York City Skyline", January 17, 1957, Fairbanks Valves were specified and installed.
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000 of the total. Tucson with 225,000 and Yuma with 36,000 population are the other major cities.

Water works and irrigation are important to Phoenix, which is in the Salt River Valley. This valley, roughly 30 by 100 miles in area, is irrigated with water from Roosevelt dam, the first big dam constructed by the Reclamation Bureau. The ancient history of this valley indicates that Indian tribes, which have mysteriously disappeared, irrigated this valley by a system of channels now very probably being used for modern irrigation canals. A potential of about one-million acres of land are available for irrigation with an annual gross production value estimated at about $400 per acre.

Engineers Help Build Arizona

Engineers in private practice have played an important part in the growth of Arizona, even extending as far back as the territorial days. The established consulting engineering firms in the state have the technical capacity and finances to handle nearly all types of projects. Phoenix quite naturally is the center of engineering activity, with 41 consulting firms listed in the telephone directory. Tucson, in Pima County, also is an important headquarters for engineering firms with some of the engineers in the capital city also maintaining offices there.

Much of the work volume also is concentrated within the Phoenix area. In fact, the City of Phoenix recently annexed 40 square miles, and this portends some very active work for consultants. The problems, however, remain the same; all of the larger cities in the state are striving to provide sufficient schools, water supplies, adequate sewage disposal, roads and streets, and airports. This is evident from a review of a few examples of engineering work being handled by consulting firms:

¶ Johannessen and Girand, designers of Sky Harbor Airport, Phoenix, which was completed only a few

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This Super-Seal motor with *Poxeal* insulation and protected bearing was not fouled by mud. An Allis-Chalmers customer, in a frequently flooded area, required a motor that could readily start even after prolonged immersion in mud.

The "dirtiest mud available" was used in conducting the successful tests in the A-C Motor Laboratories.

Motor user requirements like this form the basis for A-C pioneer-leadership in motor development. Motor buyer needs *created the most complete line of integral-horsepower motors in industry.* Induction, dc, wound rotor, synchronous, gear, tube-type and *Synduction* motors, and now *Super-Seal* motors! And, if these lines don't fill your need, A-C engineering excels in special design.

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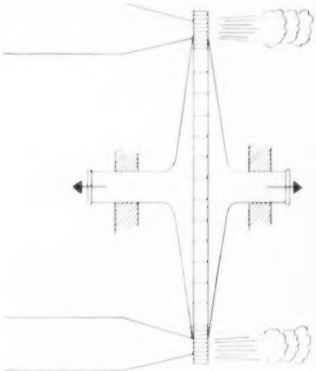

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ROTARY PUMPS

CUSTOM FLOW DIVIDER SOLVES FUEL METERING PROBLEM FOR TURBINE BUILDER

This multiple unit is a series of custom Roper pumping elements driven in tandem by a hydraulic motor. It accurately meters distillate or residual fuel oils to the combustion chambers in a large gas turbine. These rugged units, used on both mobile and stationary turbines, withstand extreme temperature changes during operation. This unusual application is another example of Roper's ability to tackle and solve — difficult pumping problems.

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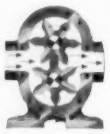
ROPER PRINCIPLE OF ONLY TWO MOVING PARTS ASSURES EFFICIENCY . . . DEPENDABILITY

Roper Pumps are the rotary gear type — two equal size pumping gears operating in a case with proper clearance. This factor promotes long service life and optimum performance on all applications.



ROPER
ROTARY PUMPS

ROPER HYDRAULICS, INC.
336 Blackhawk Park Avenue
Rockford, Illinois

years ago, has the job of planning extensive additions to the terminal and runways to take care of increases in airport use and preparation for jet planes.

¶ John A. Carollo has the engineering contract for the $3.2-million 60-mgd Squaw Peak water treatment plant addition for Phoenix. This firm also is designing a 100-mgd filtration plant for Salt Lake City.

¶ Yost and Gardner, one of the older established firms, is active in municipal paving and water and sewerage engineering work.

¶ James Hastain has contracts for county highway and municipal street paving as well as for sewer design work.

¶ W. T. Hamlyn, one of several outstanding structural engineers, designed a 20-story reinforced concrete office and club building now being erected in Phoenix. It is said to be the tallest structure of this type west of Dallas, Texas.

¶ Hoffman-Miller, another one of the older firms, has been active on Arizona's big highway program.

¶ Holmquist Engineers, Phoenix, has the engineering contract for a new city of 9000 homes and a shopping center, involving surveying and the design of all paving and sewerage and water works. The city, to be built near Casa Grande, Arizona, will be designed primarily for retired persons.

¶ John E. Stephens Associates, Phoenix, a large architect-engineer firm with broad experience in structural and paving design work, has an engineering contract with the Navajo Indian Tribe for a 1000-pupil boarding school. The project, including utilities and access roads, will cost $9 million. The firm also has a design contract for another $4-million school on a Navajo reservation. The work is being done for the Navajo Indian Community, a private tribal corporation supervised by the Federal government. Revenues are derived from tribal oil, uranium, and coal leases and sawmill operations. The tribe has a bank balance of nearly $100 mil-

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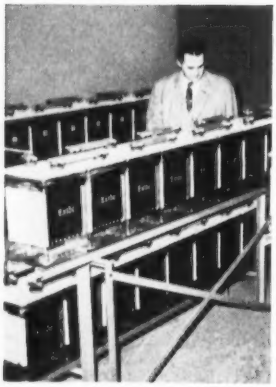

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lion to be spent for the benefit of its people.

¶ In addition, about three years ago the Arizona State Highway Department started to award engineering design work to consulting firms, after the profession convinced the legislature that this would be to the best interests of the state. Since then, up to $1 million in fees have been paid to private consultants annually. County and municipal highway work also has increased materially.

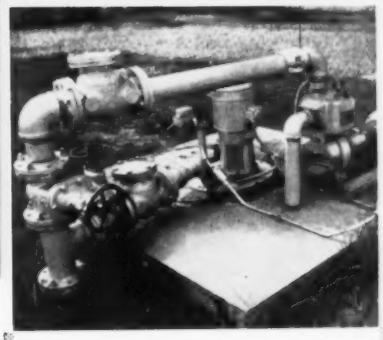
Association Activity

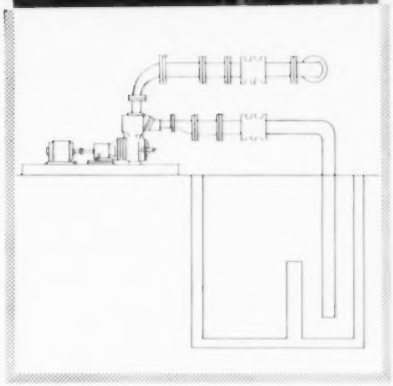
The Arizona Consulting Engineers Association has taken an active part in promoting the interests of private practice. The group originally was composed largely of engineers from Phoenix, and it also included employees as well as principals in its membership.

Recently the Association decided to reorganize and to increase its membership so it would be more representative of all consultants throughout the state. The membership also will be limited to principals of firms in conformity with the provisions in the constitutions of other state associations of consulting engineers. However, there is some question as to whether the newly reorganized association will affiliate with the Consulting Engineers Council. The majority sentiment seems to favor affiliation with the Arizona Society of Professional Engineers and NSPE.

On March 4, the new constitution and bylaws were adopted, and at an organization meeting on April 13 the new association became effective. The new officers are: James E. Hastain, president; Lloyd W. Miller, vice president; and James E. Warne, Jr., secretary-treasurer. The board of directors includes the officers, John Girand, and P. John MacNaughton. All officers represent Phoenix firms.

A committee has been set up for a membership drive, and it is anticipated that most of the consulting engineer firms in central Arizona





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In Jacksonville, Fla., a 3-inch Gorman-Rupp Sewage Pump replaced a vertical pump after 2½ years in service.

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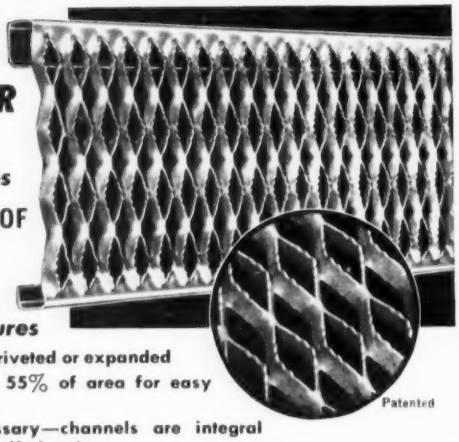

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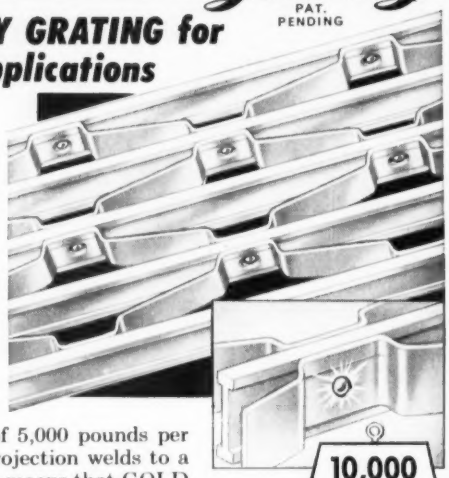

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will become active members before the next general membership meeting. Special committees also were named for the following activities:

¶ Working on a policy program.

¶ Studying all phases of relations between Arizona consulting engineers and state, county, and municipal governments.

¶ Establishing what type of program the association needs with respect to public relations.

¶ Reviewing a schedule of fees for engineering services for the City of Phoenix Improvement Districts.

CEAO Elects Officers

New officers elected by the Consulting Engineers Association of Oregon are: president, Guy H. Taylor, of Moffatt, Nichols and Taylor; vice president, Harry Czyzewski, Metallurgical Engineers, Inc.; secretary, Norman Haner, N. W. Haner and Associates; and treasurer, Harry J. Woelber, all of Portland. New directors are: metropolitan area, Marvin W. Runyan, Stevens and Thompson, Portland; and member-at-large, Robert W. Welty.

Protest Request for Bids

Consulting engineer associations of Oregon, Washington, and California have joined Idaho engineers in protesting the action of the city of Boise in asking for bids on the design of an addition to a sewerage treatment plant. The Oregon association requested CEC to send the city of Boise information on the impropriety of competitive bidding, and Guy Taylor, chairman of the CEAO committee on practice, wrote to the city warning that it may open itself to litigation in pursuing its present course.

New California Association

A new society, the Consulting Mechanical Engineers Association of Southern California, has been organized in Los Angeles. Primary objective of the group is to resolve common problems of consultants working on purely mechanical engineering matters. The

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Unannounced visitor picks random samples from production line of each Certified Ballast Manufacturer for monthly ETL test . . . so you can be sure CBM symbol always means "up to specification"

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problems include relations with architects, fees, and actions involving the Los Angeles Building Code and the school boards.

In taking this action, the mechanicals have followed a course similar to that already pursued by the structurals and electricals. For a number of years the structural engineers have had their regional associations. The electrical engineers of Los Angeles for sometime have had a similar organization to take care of problems peculiar to their branch of engineering.

While these specialized associations are not directly affiliated with the Consulting Engineers Association of California, cooperation between them and CEAC always has been excellent. Undoubtedly the same condition will prevail with the Consulting Mechanical Engineers Association of Southern California. In fact, most of its officers are CEAC members.

Officers are: J. Max Ayres, president; Donald H. Nack, vice president; and Vincent A. Megna, secretary-treasurer. Monthly dinner meetings will be held to discuss current problems.

CEAO Sticks Chin Out

The March meeting of the Consulting Engineers Association of Oregon featured an interesting panel discussion on what may be wrong with consulting engineers. Views were presented by an architect, a contractor, a materials supplier, and a city engineer.

Dick Norman, a member of AIA and the architectural firm of Jacobberger, Stanton, Franks and Norman criticized frequent lack of coordination between engineers. He said this results in conflicts among the mechanical and electrical services and the structural elements.

Charles Parker, a graduate civil engineer and general contractor, said that specifications often include unnecessary restrictions, which limit proper processing of the work. He warned that "God-save-us" clauses often result in skyrocketing costs, are frequently unenforceable, and often lead to unnecessary litigation. Contractors, he said, could help with proper specifying of construction methods.

John Silliman, vice president, American Pipe and Construction Co., a graduate civil engineer, offered four considerations that the engineer should emphasize:

¶ The consulting engineer should design for performance of a function for the least money.

¶ Consultants should confer often with people in the fabricating field who have specialized know-how.

¶ Consultants should remember that project scheduling is an important economic problem.

¶ Specifications must be prepared carefully since penalty clauses affect economics.

Gordon Burt, city engineer of Portland, decried the practice of offering free engineering in preliminary stages with the hope of promoting a design contract. ▲▲

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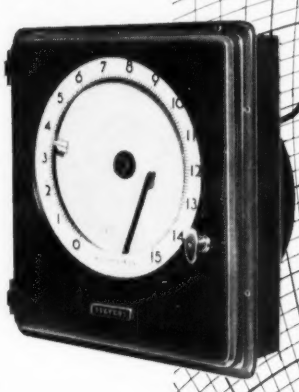

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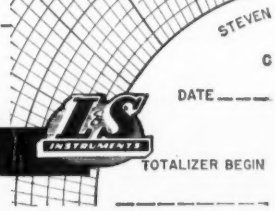

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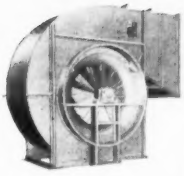

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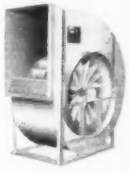

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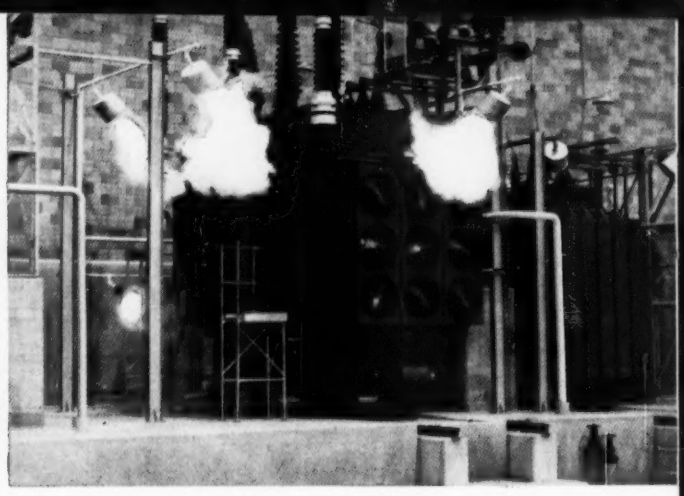

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The Saveall Automatic Sprinkler, with a solid chemical fusible element, is available in upright or pendent types at various temperature ratings. Globe also makes chemical and standard metal fusible units, automatic sprinkler system maintenance devices, window and cornice sprinklers, spray nozzles, and dry pendent type sprinklers. Globe assumes full responsibility for proper design, materials, installation and performance of every system.

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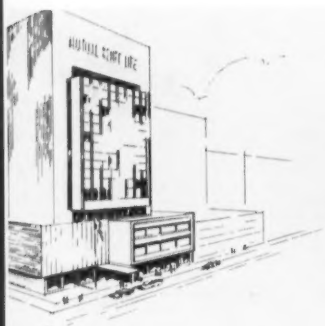

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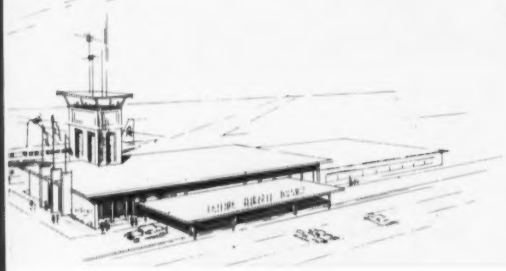

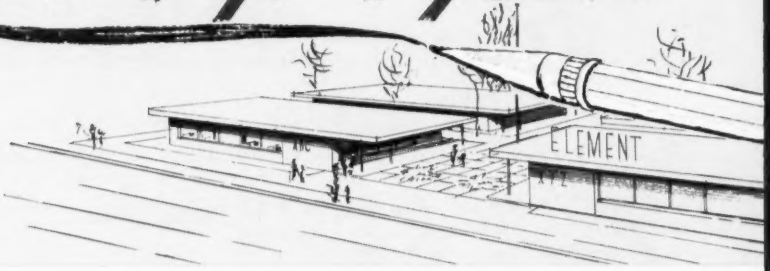

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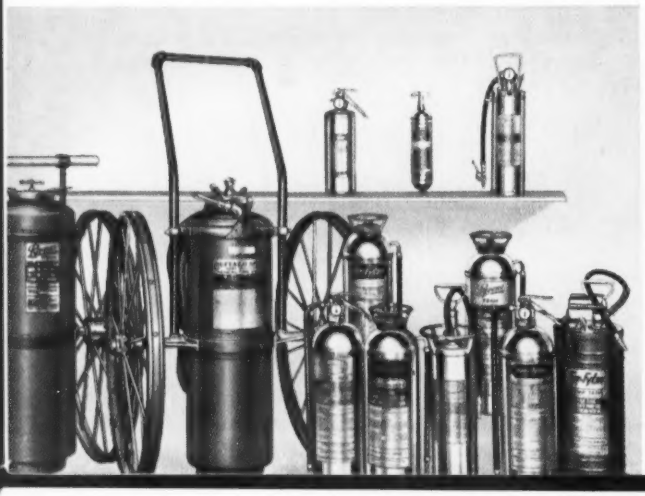

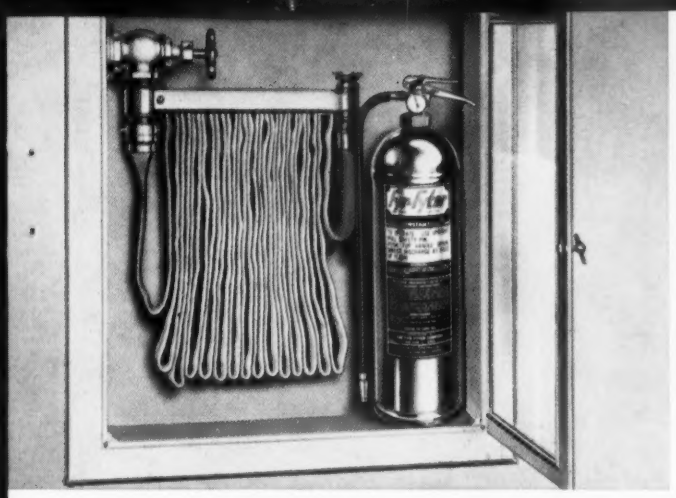

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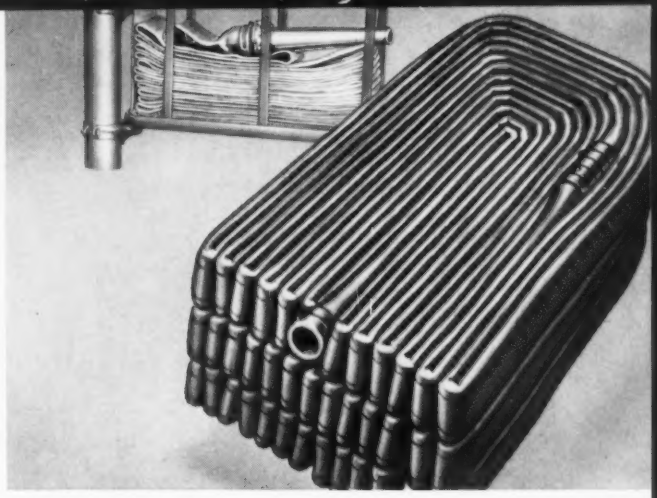

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Underwriters' and Factory Mutual approved, this equipment enhances any structure with its modern, attractive, confidence-inspiring appearance. Mass production permits competitive pricing. Yet highest quality and dependability are assured by rigid inspection, reinforced by Fyr-Fyter's reputation as the industry's largest supplier. All sales are backed by a nation-wide service organization to keep equipment in top condition.

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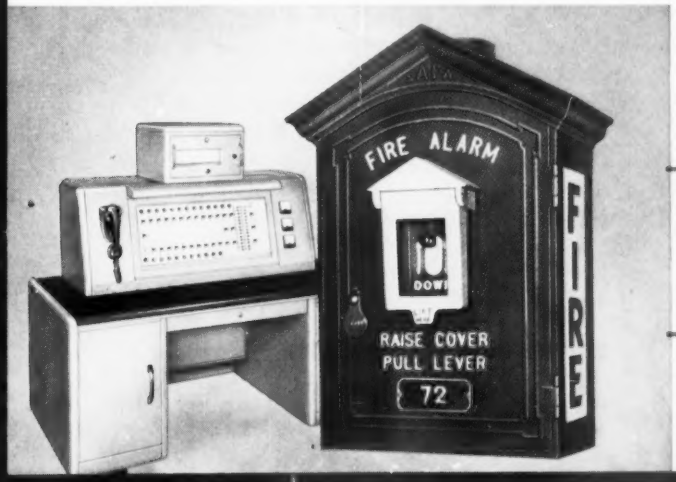

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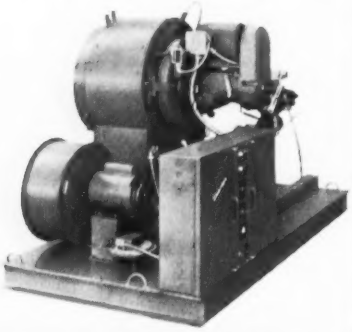

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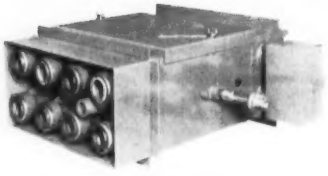

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The Word From Washington

EDGAR A. POE
Consulting Engineer Correspondent

CONSULTING ENGINEERS who are interested in foreign projects should read the new 45-page fact-filled booklet written by two economists in the nation's capital, Benjamin A. Javits and Leon H. Keyersling. This booklet, prepared after a world study, declares that it is essential that our economy be expanded through overseas investment and emphasizes that the underdeveloped areas of the world have great absorptive capacities.

The Javits and Keyersling study was designed to give all-out support to the proposed World Development Corporation. Congress is asked to pass the Act to provide the machinery and means for accomplishing about $7 billion annually of private capital from the United States to other parts of the world. Say the economists: "The challenge is most urgent. Two thirds of the world's people are hungry, living in countries where the average per capita income is less than $150 per year . . . The U.S. alone, with 6 percent of the world's population, enjoys more than 40 percent of the world's income, with an average per capita income of $2000 per year . . . The gap is widening."

Highway Lighting

The Bureau of Public Road's engineering division says the reluctance on the part of state highway departments to light interstate highways in rural areas is readily understandable. Lighting costs approximately $60,000 a mile initially, and maintenance adds $5000 or more per mile annually. Furthermore, declares Joseph Barnett, assistant commissioner for engineering, there is lack of factual justification for these expenditures.

Barnett says the $5000 yearly maintenance is about equal to the entire cost of maintaining a mile of interstate highway without lighting. He added, "We do not have a sound basis for justifying fixed source lighting on controlled access highways. Justification is available for streets and other noncontrollable highways . . . The Interstate System has no pedestrians,

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. . . a Triumph of Fixture Design!

"The finest suspension mounted fixture in years"—this will be your reaction when you've seen Sylvania's exciting new fixture series, the CLASSIC. Here is a fixture in a class all its own . . . one that will take a prominent place in your lighting plans.

To develop a completely fresh and different approach to lighting fixture design, Sylvania retained the services of the renowned industrial designing firm, Peter Muller-Munk Associates.

The result of months of concentrated effort by this firm and Sylvania's own design engineers is presented here for the first time—the CLASSIC Series.

We sincerely believe that the CLASSIC is the very finest fluorescent fixture produced in a long number of years.

Pendant mounting with diffused plastic panel

Close ceiling mounting with plastic louvers

The CLASSIC is *really* new . . . designed by experts to give commercial interiors a fresh, distinctive appearance together with outstanding illumination.

You'll like the sleek, trim lines and slim shallowness of this fixture . . . the flared, softly-diffusing side panels . . . the harmonious matching of plastic and metal . . . and the choice of three excellent shieldings.

You'll like its lighting characteristics, too. The extremely high efficiency, balanced distribution, low brightness contrasts and excellent diffusion of the CLASSIC makes it ideal for every commercial application.

To fully appreciate the CLASSIC, you must see it for yourself. Photographs and sketches cannot show the true beauty of this new series. Send today for full information. At the same time ask to have the CLASSIC demonstrated in your own office. Once you've seen it, you'll agree that this Sylvania fixture is truly a triumph of fixture design.

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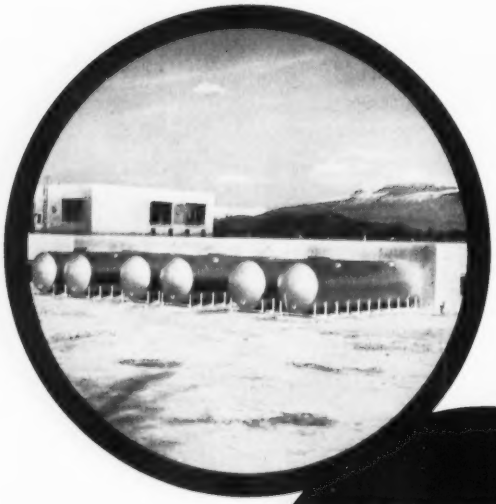
FLUORESCENT LIGHTING FIXTURES AND SYSTEMS • BEST FIXTURE VALUE IN EVERY PRICE RANGE



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. . . even when backwashing GFC Multi-Cell Filters

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no crossings at grade, a wide planted median so that headlight glare is minimized, and adequate shoulders."

Considerable highway lighting research is taking place in scattered sections of the country. For instance, experiments with high and low level lighting are being conducted on the New Jersey turnpike south of the Newark Airport, and studies also are being made on the Connecticut Turnpike. Texas A. & M. College has a long-range experiment under way in which the actual operation of vehicles at interchanges is being studied with different types and with varying intensities of lighting.

Federal Aid to Airports

A compromise version of a four-year airport building program will go on the statute books. The House-passed version proposed $297 million of Federal funds, while the Senate bill called for $465 million. Traditionally, Senators, up for election every six years, are more liberal in spending than Representatives, up for election on the shorter cycle of every two years.

Issuance of a new updated booklet on small airport planning has been made by the Federal Aviation Agency, which came into being January 1. The publication, "Small Airports," describes airport site selection, design, construction, and financing. Although drafted to aid planners and engineers of public airports, the data also are applicable for private airport planning.

Missile Manufacturers

The Pentagon is convinced that the current missile manufacturing pattern is similar to the automotive manufacturing pattern that existed 40 years ago. Four decades ago there were dozens of automobile makers as compared with the handful today. Brigadier General Austin W. Betts, executive assistant for missiles to Defense Secretary Neil McElroy, expresses the conviction that the time is not too far away

Enjay Butyl window-sealing tape was employed throughout the newly erected Industrial Reactor Laboratories in Plainsboro, N. J. Architect: Skidmore, Owings & Merrill

ENJAY BUTYL

caulking prevents leakage in new Atomic Reactor Lab

Butyl caulking tape permanently seals joints and copings against leakage in this new Atomic Reactor Lab. Tough, weather-resistant Butyl helps provide long-lasting protection against all climatic conditions. Enjay Butyl was chosen to do this job because of its inherent resistance to sunlight, ozone, moisture, aging and vibration.

Architects and design engineers are constantly finding new ways to use Enjay Butyl in building and construction. Its many outstanding qualities —plus its low cost—make it perfect for use in a wide variety of applications. Call or write our nearest office today for a complete list of suppliers.

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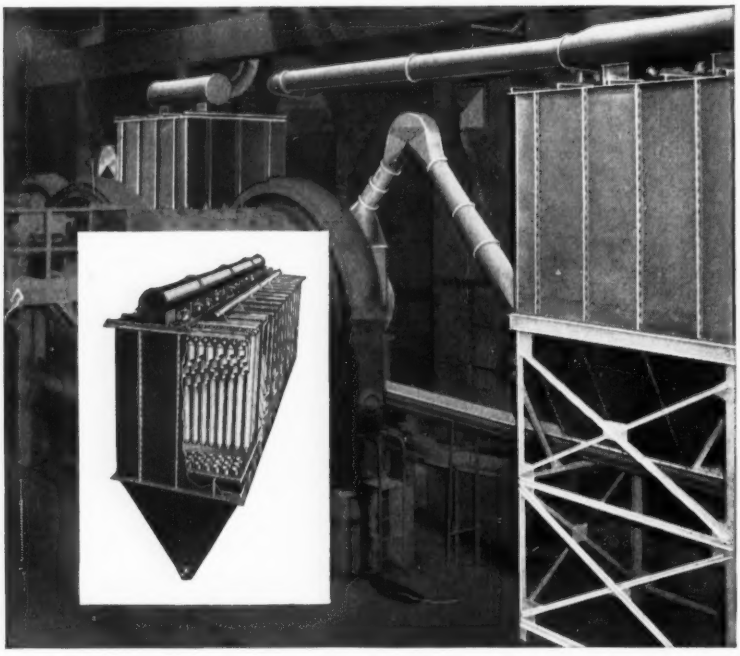
Dust Collection Systems



Dependable Heavy Duty Service at Low Cost

Continuous operation at full rated capacity is the performance that Norblo Equipment delivers every day in many types of plants. Norblo's rugged construction, basic unit compartment and few moving parts insure low cost of operation and maintenance. A most important advantage of this equipment is its adjustability for varying dust loading which can be made in a few minutes without shutting down the installation.

Modern industrial "housekeeping" calls for the removal of injurious or "nuisance" air contaminants in the interest of highest efficiency. For certain industries, *recovery* is important also. In large scale operations even small fractions of a per cent better efficiency of fume or dust recovery can mean thousands of dollars a year gained.

Investigate the possibilities of Norblo Dust and Fume Collection for cleaner air, or for recovery of valuable material. Write for Bulletin 164.

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Norblo ENGINEERED DUST COLLECTION SYSTEMS FOR ALL INDUSTRIES

when there will be fewer guided missile manufacturers.

Said McElroy, "With fewer missile systems, we will need fewer development teams. With more complexity, each team will have to be technically more versatile . . . We are going to have to support fewer and better systems, which in turn is going to mean there will be fewer producers."

Weights and Measures

Effective July 1, the six major English-speaking nations will have exactly equal measurements of length and weight, having agreed upon a common inch and a common ounce. While past differences have been hair-splitting, they nevertheless are significant in today's growing industrial society.

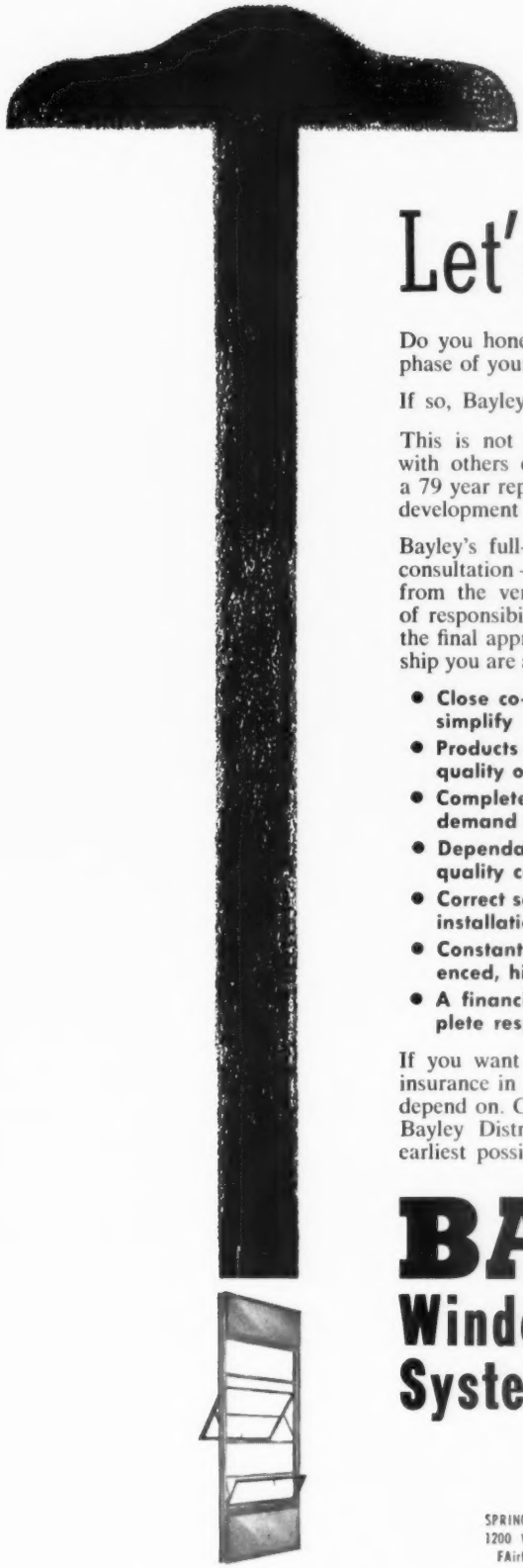
When the "new" inch becomes formally effective, there will remain one major U.S. holdout. The Coast and Geodetic Survey's maps and reference points are based on the 2.54000 centimeter inch. The Survey will continue measuring distances at its old standard, designated the "American survey foot."

Meanwhile, there are several efforts under way to standardize weights and measures. Next year in Paris there will be a General International Conference on the subject, the 10th meeting since 1875.

Bridge Clearance Standards

A bridge clearance requirements bill, designed to focus attention on the rising costs of building spans over navigable streams, is before Congress. Authored by Senator Francis Case, Republican of South Dakota, and backed by the Eisenhower Administration, it would require Federal recognition of the equal rights of all forms of transportation when bridge clearance standards are set.

Under present law only the needs of ships and barges must be considered. The Case measure would require government officials to weigh the economic effect on all industries — including road build-



Let's Talk Straight!

Do you honestly want quality, in its full sense? Quality in every phase of your dealings with windows or curtain-walls?

If so, Bayley can play an important role on your projects.

This is not an idle claim. It's a fact substantiated in working with others on outstanding projects throughout the nation — by a 79 year reputation for reliability and leadership in the design and development of products for the building industry.

Bayley's full-scope *quality* service starts by offering experienced consultation — with a conscientious desire to be of real help — from the very inception of your building project. With a sense of responsibility to you this policy of help continues even beyond the final approval of the finished building. And during this relationship you are assured of:

- **Close co-operation in submitting detailed drawings that will simplify your work and avoid later drawing revisions.**
- **Products built to the latest proven standards of design and quality of construction.**
- **Complete and detailed specifications that will support your demand for quality products.**
- **Dependable delivery of all materials to the job, in top quality condition.**
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If you want to incorporate this type of window or curtain-wall insurance in your building project, Bayley is the company you can depend on. Call in your local Bayley representative — or write the Bayley District Office or Home Office in Springfield — in the earliest possible stages of your plans!

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ers and utility operators – before fixing bridge clearances or calling for open spans.

Radioactive Waste Disposal

A license to a New Britain, Connecticut trucking company for disposal of low-level radioactive wastes has been granted by the Atomic Energy Commission. The trucking company has authority to collect prepackaged and labeled wastes, provide further packaging, and dispose of the materials in the ocean about 100 miles off Long Island, N.Y. Waste containers are to be reinforced with concrete dense enough to permit sinking at the bottom of the ocean.

Electric Automobiles

Government officials are watching with interest the attempts to revive the electric automobile. With air pollution worsening and smog plaguing some cities, there is marked interest in the storage battery powered auto projects of firms in San Diego and Cleveland. Dozens of electric utility companies already have ordered the initial production models for their own testing and promotion purposes.

Water Projects

The Bureau of Reclamation is working on 73 water projects, designed to provide industrial and agricultural growth in water-short areas of the 17 western states. When completed, the projects will provide irrigation water for 5,657,000 acres of land. Electric power will be produced in 14 plants, with ultimate capacity of over 1.5-million kw.

Interstate Highway Program

General Louis Prentiss, executive vice president of the American Road Builders Association, recently told the House Subcommittee on Roads: "I want to point to the valuable contributions made to the acceleration of the Interstate Highway program by the consulting engineering profession. A recent study indicates that consultants have performed nearly 40 percent of the nationwide engineering load. It is evident now that a sufficient reserve capacity has been built up by all segments of the industry to meet all foreseeable demands."

The Congressional committee is considering ways to raise $4500 million to meet a deficit in the Highway Trust Fund over the two-year period, 1961-62, and keep the mammoth public works program in high gear. Unless measures are devised this session to bring more money into the Fund, there will be no apportionment to the state highway departments this summer as scheduled, and only $500 million next year, instead of the $2500 million authorized for each year.

The major point of General Prentiss' testimony was that a slowdown in the national road building effort now would be disastrous to the highway construction industry and would cause real hardship

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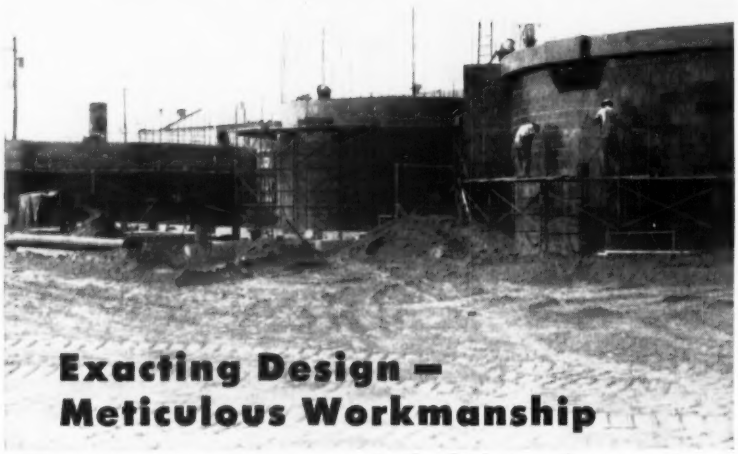

Exacting Design – Meticulous Workmanship

As the final step of construction, Stebbins workmen carefully wash down the exterior of the tanks with acid.

In this view of tank floors under construction, note the clean, smooth joints – the mark of good workmanship. Note the variety of tile shapes. Horizontal and vertical steel reinforcing is shown in the walls which will be solidly filled with concrete as work progresses.

Complete Service – Design, Installation, Maintenance

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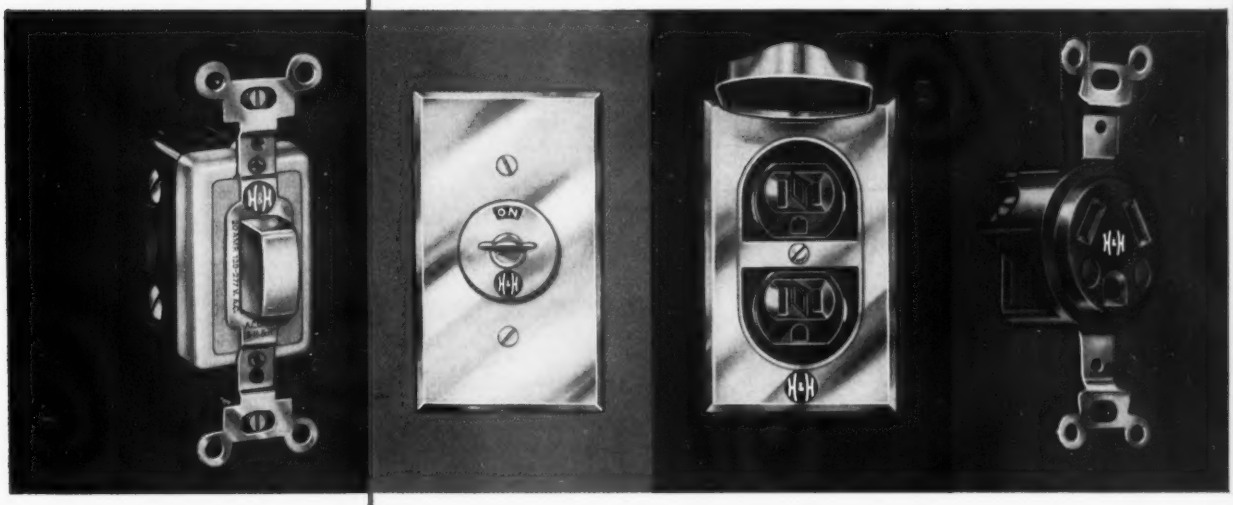

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a. QUIETTE TAP ACTION SWITCH 2891-I
15 amp., 120-277 V.
b. CORBIN ROTARY LOCK 1281
Flush Type with plate
10 amp., 125 V.; 5 amp., 250 V.
c. DUPLEX WEATHERPROOF
GROUNDING TYPE RECEPTACLE 5262-WP
15 amp., 125 V.
d. GROUNDING TYPE RECEPTACLE 7621
20 amp., 277 V.

WHEN YOU THINK OF WIRING DEVICES, THINK OF ARROW-HART

to consultants who have built up their organizations to handle the accelerated work load.

Another witness, R. R. Bartelsmeyer, president of the American Association of State Highway Officials, also declared that consultants who are handling much of the engineering for 16 state highway departments would be hurt by the interruption. He said: "Our poll shows that if no apportionment is made for 1961, it will have a decided effect on the technical personnel of the state highway departments, to the point that 32 of them probably will have to dismiss engineering and technical personnel recruited and trained for the enlarged work load. Two states advise that they have the state funds to continue the employment of such personnel on the state's payrolls in order to retain them for the time that the program should be resumed. The balance of the state highway departments use consulting engineers to a great degree in handling the additional work load caused by the Interstate program, and in this case, the adverse economic impact would be directly on the private engineering firms."

Subsidies Challenged

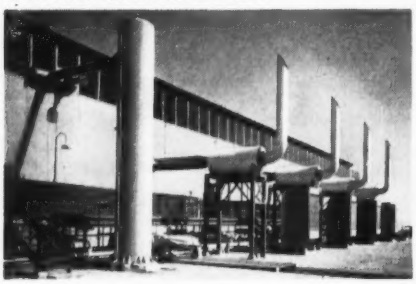
Congress has before it a vigorous protest from the National Coal Association that proposed Federal subsidies for atomic power plants would in effect use the U.S. Treasury to help drive the bituminous coal industry out of its best market, thus throwing more miners and railroad men out of work. The coal industry does not fear atomic energy competition on a "realistic basis," but it does fear atomic power if artificially low costs result from Federal subsidies, NCA declares.

NSPE Aids Consultants

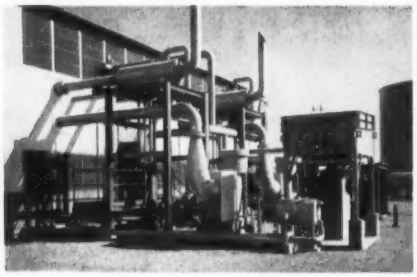
The National Society of Professional Engineers again has entered a protest with reference to pending TVA legislature. The measure would authorize the Tennessee Valley Authority to issue up to $750 million of revenue bonds for power expansion, and would permit TVA engineers to do design work for industries or firms locating or already established with the TVA area. NSPE objects only to the engineering provisions, on the ground that there should not be interference with the independent practice of professional engineers.

In another action, NSPE questioned a provision in HR 5915, Title IV, Section 401, which places a limitation of 5 percent of the total construction cost for engineering and design. NSPE contends that such a restriction "ignores the practical conditions which actually exist in the consulting engineering field, and instead, imposes what amounts to an arbitrary limitation regardless of the size and complexity of the project involved, contrary to basic considerations in the setting of reasonable and fair engineering fees." ▲▲

COMPRESSORS AND



GENERATORS ARE



MAXIM-QUIET

The new Needles, California Compressor Station operates with quiet efficiency. Maxim Silencers cut down exhaust noise and intake pulsation to the minimum. Specify the world's most widely used silencer—a Maxim. There's no quiet like *Maxim-Quiet.*

Photos courtesy of Southern California and Southern Counties Gas Companies

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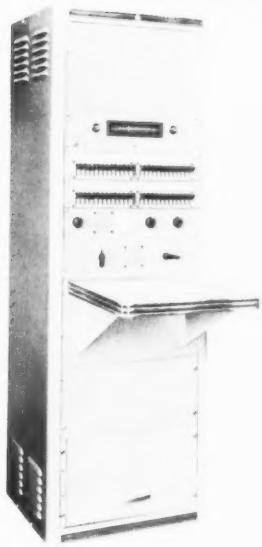
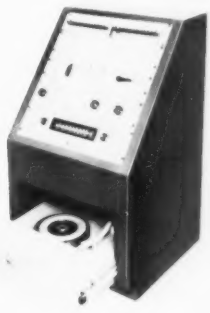
AUDIO NEWS
for consulting engineers

RCA SOUND SYSTEMS NOW MADE TO ORDER FROM PREWIRED PLUG-IN ASSEMBLIES





New Modular RCA Sound Controls use standard panels mounted in a variety of cabinets. Note how the intercom panel mounts in either a rack, console, turret, or desk.

RCA's new modular sound control systems are of significant importance to consulting engineers and clients because they *permit quick selection of assemblies to meet exact requirements*, are *unusually simple to operate*, and *provide greater reliability at lower cost*.

These new "building block" systems from RCA are based on the four basic cabinets illustrated and a wide selection of standard assemblies which can be installed in many combinations—affording a high degree of flexibility.

Flexibility of Design

RCA's Modular Sound Control System assemblies are mounted on 19 inch panels and stocked as standard units.

Planning and specifying an RCA system is greatly simplified—merely requires determining the functions to be accomplished by the sound system and selecting the standard assemblies and cabinet which best match the requirements. The specified elements are prewired with plug-in connections; are custom assembled by factory experts, and shipped ready for installation. Once one of these flexible systems is installed, the modular-construction concept makes later expansion easy. Service, too, and parts replacement become greatly simplified.

Simple to Operate

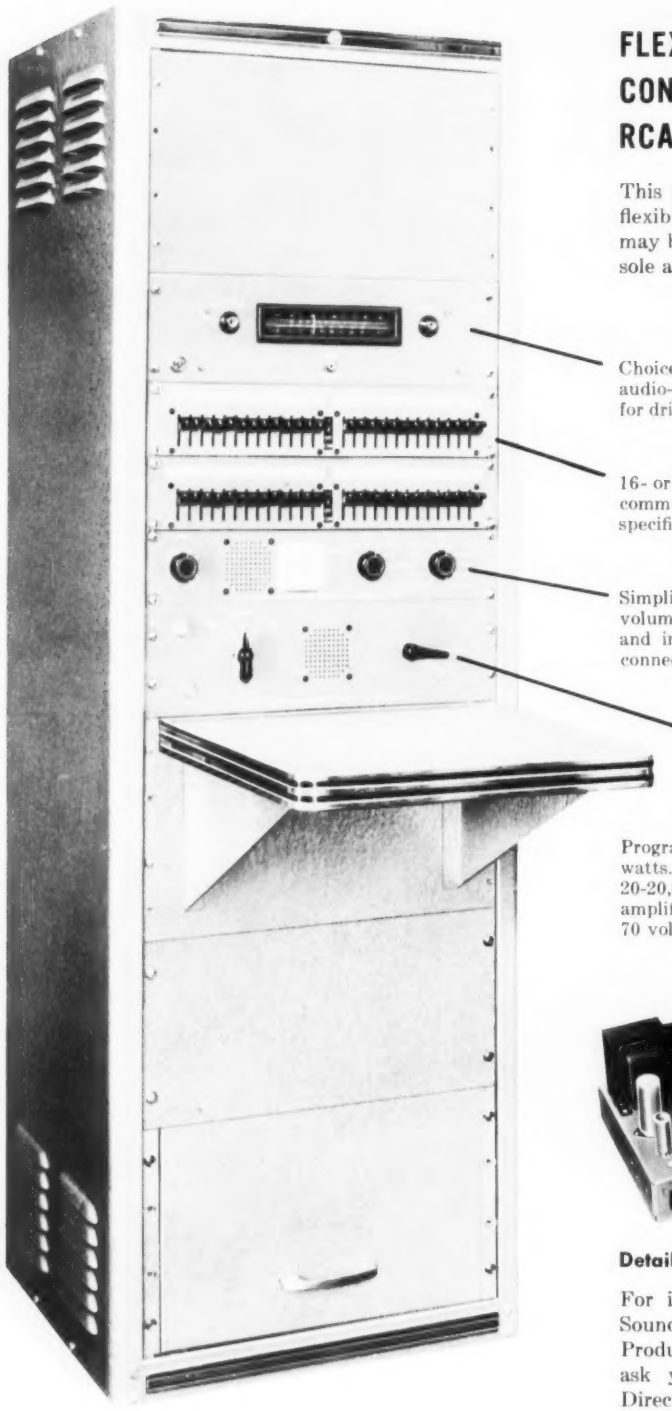
Simple operation combined with flexibility are characteristic of RCA's modular design. The number of operating controls, switches and knobs have been reduced to essentials without detracting in any way from the functions of the system. The program panel, for example, has only three controls. The intercom panel is equally simple and incorporates a combination monitor-loudspeaker and microphone. It also features RCA's single "ALL-CALL" switch that instantly gives full amplifier power to all loudspeaker locations for emergency announcements.

Easy to Install and Maintain

Reliable performance at lower cost is an inherent advantage of these new systems. Installation is readily accomplished, since the systems are shipped with all units mounted in place, with plug-in connections for easy hookup at the job site. Before leaving the factory, the individual assemblies are tested and the entire system is checked out to meet RCA's rigid quality standards. Components are readily accessible for service and parts replacement.

Assemblies for RCA Modular Sound Systems are illustrated and briefly described on the next page.

AUDIO NEWS for consulting engineers



FLEXIBILITY AND OPERATING CONVENIENCE KEY FEATURES OF RCA MODULAR SOUND SYSTEMS

This rack mounted RCA Sound System illustrates the flexibility and convenience of modular design. Elements may be varied in location in this rack or in the desk, console and turret cabinets also available.

Choice of standard or deluxe AM-FM Tuner . . . extended audio-frequency range . . . extreme sensitivity . . . AFC position for drift-free reception.

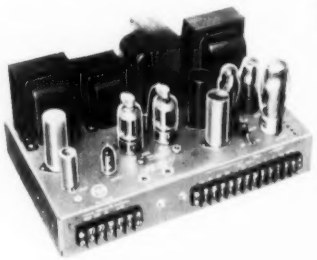
16- or 26-key switchbank panels for controlling program and communication available. As many panels as needed can be specified. Optional light annunciators.

Simplified program panel contains only three control knobs: volume control, monitor selector switch to control distribution and input selector. All cabling terminates in plugs for easy connection.

Intercom panel includes a talk-listen switch and one for intercom-all-call selection. Monitor microphone built into the panel—separate desk mike not required.

Program amplifiers 35 or 70 watts. Frequency response 20-20,000 cycles; intercom amplifier 10 watts; 25 and 70 volt output taps.

Automatic 4-speed changer plays up to 12″ records at 78, 45, 33⅓ and 16 rpm. Intermixes 10″ and 12″ records . . . oversized 4 pole, 3-coil motor provides hum-free operation at all speeds. Manual turntable also available.



Detailed Information Available at Your Request

For information and specifications on RCA Modular Sound Systems and their assemblies, write to Sound Products, Dept. U-302, RCA, Camden 2, New Jersey, or ask your Sound Distributor. He's in the classified Directory under "Public Address and Sound Systems". Either way, there's no obligation.

RADIO CORPORATION of AMERICA

SOUND PRODUCTS CAMDEN 2, NEW JERSEY

Tmk(s) ®

Heard Around Headquarters

At The Annual Convention of the New York State Society of Professional Engineers in New York City this month, two additional rules for the NYSSPE definitions of unethical conduct will be up for consideration.

The State Education Law merely says an engineer can be disciplined for "unprofessional conduct as defined by rules and regulations promulgated by the regents."

NYSSPE has prepared a seven-point "spelling out" of what is unethical. Under consideration as possible additions to the seven-point list is making it unethical to split fees, and making discipline possible when an engineer fails to complete a project within a reasonable time without good cause.

The current NYSSPE Rules of Unethical Conduct are:

"Unprofessional conduct in the practice of professional engineering or land surveying shall include but not be limited to the following acts or omissions to act by a licensed and/or registered engineer or land surveyor:

1. Offering to pay, paying or accepting, either directly or indirectly, any substantial gift, bribe, or other consideration to influence the award of professional work.
2. Failure to exercise due regard for the safety of life or health of the public or any employee who may be affected by professional work for which he is responsible.
3. Associating himself with any project known to him to be fraudulent or dishonest in character.
4. Knowingly permitting, without proper authorization, substantial disregard by any contractor of plans or specifications when professional supervision of the work is under his control.
5. Accepting a substantial gift, bribe, commission or other consideration from any contractor or any other party dealing with his client or employer in connection with work on which he has professional responsibility.
6. Having a financial interest, without the knowledge of his client or employer, in the bids of any contractor for work on which he has professional responsibility.
7. Being knowingly untruthful or deceptive in any professional report, statement or testimony.

ARBA Considers CEC Request

A proposal by the Consulting Engineers Council that the CEC and the American Road Builders Association Engineering Division work together on mutual problems has been referred to the newly formed engineering division public relations committee, headed by

NOW

an entirely new concept in water cooler design!

Completely self-contained, refrigerated electric wall fountain. Capacity: 13 g. p. h.

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. . . the "quality line" presents

WALL-TEMP

Model WT-13

With completely new functional beauty and great new flexibility—wall mounted model WT-13, by Temprite, presents an entirely new concept in the design engineering of drinking water coolers. Designed for maximum architectural efficiency wherever self-contained coolers are specified—Model WT-13 is in complete harmony with today's building trends.

1 Mounts flush to wall.
2 Fully concealed plumbing.
3 Ample head room.
4 Floor cleanliness; foot freedom.
5 Extra deep basin.
6 Mounts at child's height if desired.

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Mason Lockwood, of Lockwood, Andrews and Newman, Houston.

T. Randolph Russell, public relations director for ARBA, explained that it is a foregone conclusion that ARBA wants to cooperate with any engineering organization which has mutual aims and problems. The question now is where to begin.

ARBA also has written a formal policy statement on the position of ARBA with regard to the use of consultants by state highway departments. The statement is merely a clarification of present policy — that consulting engineers should be used for peak loads and for unusual design projects.

New engineering division committees, in addition to Lockwood's public relations group, are a committee on prequalification of engineers, with W. H. Corddry of Gannett, Fleming, Corddry & Carpenter Inc., Harrisburg, Pa., chairman, and the engineer half of a joint contractor-consulting engineer committee is T. Carr Forrest of Forrest and Cotton, Dallas.

helping the CONSULTING ENGINEER
to select insulated wire and cable
There are many factors that help a consulting engineer select insulated wire and cable. Environmental conditions such as heat . . . moisture . . . cold . . . oil . . . grease . . . corrosive vapors . . . and general operating conditions influence the choice of type of insulated wire or cable. Amperage, voltage and diameter limitations too must be weighed carefully in making up the specifications.
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C AVA STATION CONTROL CABLE
D VARNISHED CAMBRIC POWER CABLE

Wrong Number

A Long Island resident learned about engineers' stamps the hard way recently, when he was fined $100 for practicing engineering without a license.

John C. Loughlin, of Copiague, L.I., had moved to the area in May 1958, and hung up a sign advertising himself as a construction engineer. He also had a bogus engineer's stamp made.

Saying he was too busy to do his own engineering, Loughlin took some stamped drawings to Julius Schubert, president of the Long Island Chapter of the New York State Association of Consulting Engineers. Schubert, who is older than Loughlin, noticed that Loughlin's license number was 6409 (Schubert's is 26,280). He decided something was wrong, since that would have been a very early license for a man of Loughlin's age.

Loughlin was arrested on his first attempt to practice engineering.

No Summer Vacation

According to the *Journal of Engineering Education*, Pennsylvania State University "has taken the first tentative step toward eliminating the traditional summer vacations."

Offering undergraduate courses all year, the new program will allow more students to enroll with present school facilities. Students also can either take more courses during their undergraduate years or graduate earlier.

The summer school option, however, is not compulsory.

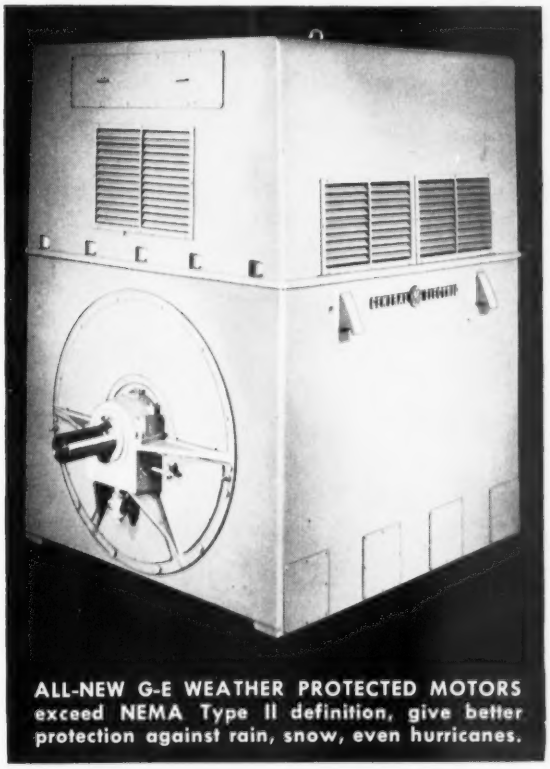
No Ford Grant

The Ford Foundation has indicated to the joint EJC-ECPD committee that the Foundation will not sponsor a comprehensive survey of the engineering profession.

Columbia University's Bureau of Applied Social Research worked

FROM GENERAL ELECTRIC . . .

New Custom-designed Power Station Motors Provide Better Protection, Easy Maintenance



ALL-NEW G-E WEATHER PROTECTED MOTORS exceed NEMA Type II definition, give better protection against rain, snow, even hurricanes.

Now, you can get a new General Electric motor custom-designed for your specific power station requirements. Nine custom-designed enclosures—eight custom-designed insulation systems—seven custom-designed bearing and end shield constructions—more than 15 custom-designed accessories—and a countless number of electrical designs: these give our engineers freedom to create a power station motor that can meet your exact needs. General Electric's all-new weather protected motor, shown at left, is one example of how a motor can be custom-designed for its particular application.

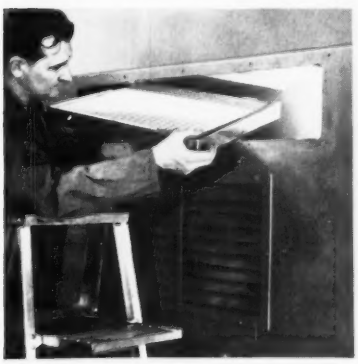
CUSTOM-DESIGNED FOR BETTER PROTECTION—Unique labyrinth baffling system of new weather-protected motor forces incoming air to make a series of right-angle turns and reductions in velocity before entering motor. And, special "blow-through" passages give extra protection against high-velocity winds.

CUSTOM-DESIGNED FOR EASY MAINTENANCE—New end shield is lightweight, easy to remove and disassemble, eliminating need for crane or lifting rig. Vistamatic sight gages are located on top and both sides allowing oil ring observation and easy reading of oil level.

CUSTOM-DESIGNED FOR GREATER ACCESSIBILITY—Removable top section provides access to all air passages and baffles for easy inspection, maintenance. Motor windings and bearings are easy to reach because of new end shield which is lightweight and easily removed.

FOR MORE INFORMATION on General Electric custom-designed power station motors, contact your nearby G-E Apparatus Sales Office or write to Section 884-1, General Electric Co., Schenectady, N.Y.

GENERAL ELECTRIC



TOP ACCESSIBILITY—Air passages in top section are completely accessible through nine openings. Filter installation or inspection is fast and easy.

BETTER PROTECTED AIR OPENINGS—"High up" air intake passages of new G-E motor prevent snow, trash, dust or dirt from being drawn into the motor.

SIMPLIFIED MAINTENANCE—Removable, lightweight end shield permits complete accessibility to motor interior, bearings without disturbing alignment.

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GREATER CAPACITY . . . thru STRONG "lever-lift" trap action
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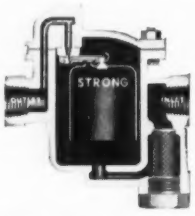
LONGER LIFE . . . thru extra-heavy cast or forged construction
LESS WEAR . . . only two parts move — no pins on larger traps
INTERCHANGEABLE INTERNAL PARTS . . . made of tough stainless steel

STRONG'S complete line contains a trap for every steam system: 0 to 2500 psi, 0 to 1100°F, 0 to 100,000 lbs/hour.

Horizontal, in-line traps:

140, 141, 142, 143, 144 (semi-steel): pressure-temperature limit — 250 psi at 450°F; capacities to 11,500 lbs/hour



140S, 141S, 142S (semi-steel): same as 140-142, with a built-in strainer for removing foreign matter.

140T, 141T, 142T (semi-steel): same as 140-142, with a high capacity thermal vent for faster heating

Bottom inlet, top outlet traps:

42, 43, 44, 45, 46 (semi-steel): pressure-temperature limit — 250 psi at 450°F; capacities to 42,800 lbs/hour

643, 644, 645, 646 (cast steel): pressure-temperature limit — 600 psi at 800°F; capacities to 42,800 lbs/hour

1543, 1544, 1545, 1546 (forged SAE 4130 Chrome-Moly Steel): pressure-temperature limit — 1500 psi at 950°F; capacities to 42,800 lbs/hour

642 (forged steel): pressure-temperature limit — 400 psi at 850°F; capacities to 2665 lbs/hour (not illustrated)

2544, 2545, 2546 (forged ASTM A335-P22 Chrome-Moly Steel): pressure-temperature limit — 2500 psi at 1100°F; capacities to 42,800 lbs/hour (not illustrated)

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out procedures of conducting such a survey more than one year ago. Estimated cost was $1,803,000.

The matter was kept under consideration for some time by the Ford Foundation, which finally decided the donation of individual grants was more in keeping with Foundation policy.

At present, the suggested survey procedures are being divided into several sections, based on the assumption that a sponsor could finance only a portion of the survey if it so desired.

Committees Invited

The Engineers Council for Professional Development has invited a representative from education committees of the Founder Societies to attend meetings of the accreditation committee. Purpose of this is to acquaint education committee members of the various groups with both the problems and the progress of the accreditation organization. Chief among the problems is the need for men from private practice and from industry to serve on accreditation groups.

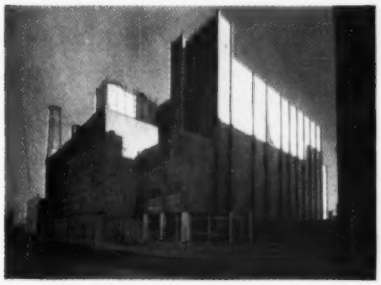
The education members were invited with the important understanding that all information from the accreditation discussions is to be kept confidential.

Student Exchange

Engineers Joint Council has taken another step forward into the international engineering picture, with the sponsorship of the U.S. National Committee for the International Association for the Exchange of Students for Technical Experience.

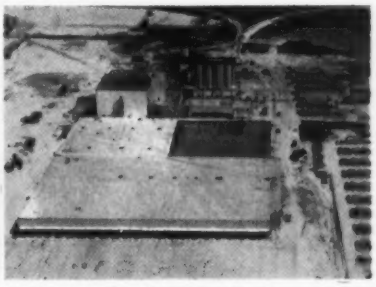
This program, known as IAESTE, is a cooperative effort of 28 nations in the exchange of students. Under the IAESTE plan, the student pays his own expenses. The IAESTE group arranges a job which would give the student technical experience and a knowledge of engineering methods in the United States. The employer must pay "maintenance" wages. And the student is

The Schlitz "headquarters" brewery at Milwaukee uses 4 pulverized coal-fired C-E boilers, Type VU, each with a capacity of 60,000 lb. per hr.

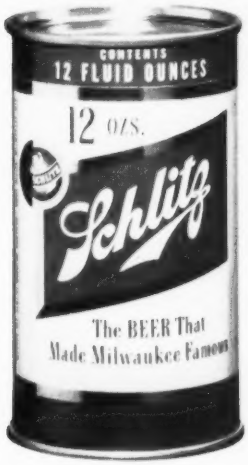


Two oil-fired C-E boilers, Type VU-10, supply 60,000 lb. of steam per hr. for process purposes at the Schlitz brewery in Brooklyn, N. Y.

This 20-million dollar showplace is the Schlitz brewery in Los Angeles, California, which uses 3 C-E boilers, Type VU-10. Fired with natural gas and oil, they generate 90,000 lb. of steam per hr.



At its Tampa, Florida, brewery, Schlitz uses 2 semi-outdoor C-E Package boilers, Type VP. They provide 72,000 lb. of steam per hr.



"The Beer That Made Milwaukee Famous"...

is brewed with C-E STEAM

Eleven C-E boiler units, ranging from the semi-outdoor, oil-fired package type to the pulverized coal-fired, vertical unit type, provide the steam to make "The Beer That Made Milwaukee Famous."

Since 1946, when the Jos. Schlitz Brewing Company purchased four C-E boilers as part of an expansion and modernization program at Milwaukee, the Company has purchased C-E units for its breweries in Brooklyn, N. Y., Los Angeles, Calif., and Tampa, Fla.

Due to the nature of brewing and bottling operations, load swings are wide and rapid, and boiler response must be both unfailing and prompt. How well C-E boilers have met this challenge is evidenced by the repeat order record—a record made even more impressive by the fact that the Jos. Schlitz Brewing Company has obtained consistently high performance with not just one type of C-E boiler — but with three.

When you need a reliable and efficient source of steam — remember that the Schlitz slogan "Move Up to Quality" applies to boilers as well as beer.

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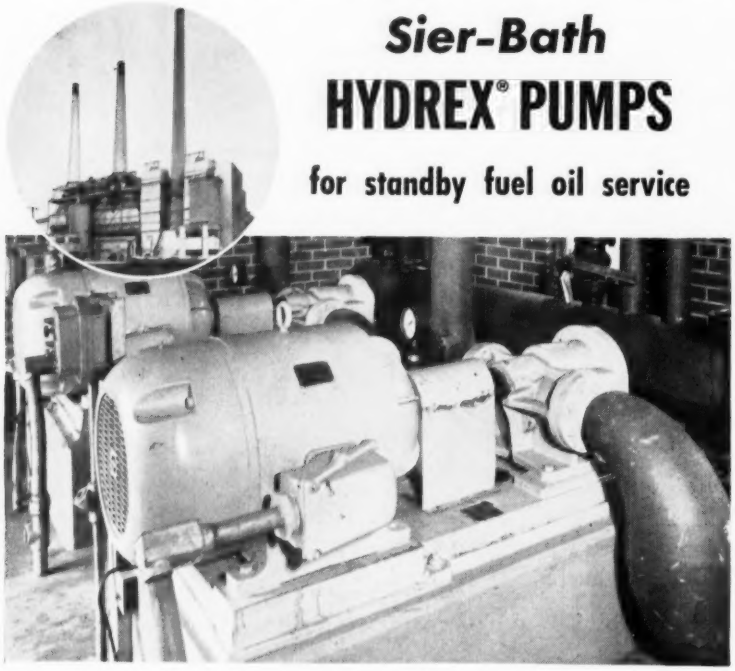
Detroit Edison River Rouge Power Plant selects

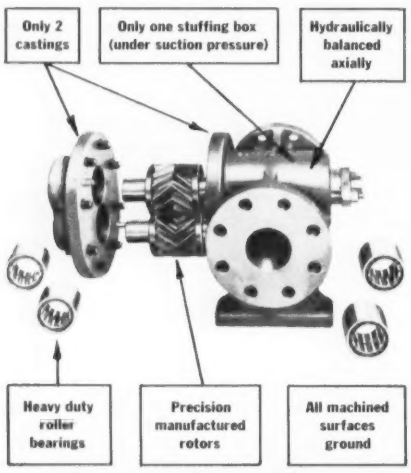
Sier-Bath HYDREX® PUMPS

for standby fuel oil service



• This Detroit Edison coal-fired power plant is ready for a quick switch to oil-firing, should any emergency threaten the flow of coal to the boilers. Standing by are two dependable Sier-Bath HYDREX Pumps to instantly pump 300 gpm. of Bunker "C" Fuel Oil having 3,000 SSU viscosity at 122°F., with 20 foot suction lift at 100 psig. Heated oil is piped to the pump house by gravity feed, then pumped to the power house by the HYDREX Pumps.

Sier-Bath HYDREX PUMP


Only 2 castings
Only one stuffing box (under suction pressure)
Hydraulically balanced axially
Heavy duty roller bearings
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The simplest heavy duty gear pump made! Use it in place of pumps costing much more...for handling chemicals, fuel oils, lube oils, hydraulic liquids, etc.

The "Hydrex" needs no costly speed reducer—can be direct-connected up to 1800 RPM. Extreme simplicity allows heavier construction, easier installation and maintenance, less downtime, longer life.

Models available to pump liquids from 32 SSU to 500,000 SSU, at 1 to 350 GPM, up to 500 PSI. See "Yellow Pages" for your local Sier-Bath Pump Representative or write to *Sier-Bath Gear & Pump Co., Inc., 9257 Hudson Blvd., North Bergen, N. J.*

Sier-Bath ROTARY PUMPS

Screw Pumps — Gearex® Pumps — Hydrex® Pumps

Founded 1905 — Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings — Member A.G.M.A.

required to return to his own country at the end of eight weeks.

The exchange program was referred to EJC because of its varied contacts in the engineering field.

More Who's Whos

Upon completion of "*Who's Who in Engineering*" this year, with 18,000 engineers now listed, the Lewis Historical Publishing Co. is getting ready for its next two projects — "*Who's Who in New York City and State*" (13th Edition) and "*Who's Who in Chemical Engineering*" (5th Edition). Any consulting engineer interested in being included in either can contact CONSULTING ENGINEER Magazine.

They Like Yellow

Wyoming legislators are of the nonconformist type this season. The legislature has approved yellow center-line highway markings, which do not conform to Bureau of Public Roads Standards. ▲▲

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ARTICLE REPRINTS

For free copies of reprints listed below, write on company letterhead to Reader Service Dept., CONSULTING ENGINEER 217 Wayne St., St. Joseph, Mich.

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"My Approach to High Frequency Lighting"
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NEWS FROM YARWAY

NOW! A NEW YARWAY UNIT TANDEM BLOW-OFF VALVE FOR MEDIUM PRESSURE BOILERS

There's a new star in the Yarway Blow-Off Valve line.

For years rugged Yarway Unit Tandem Blow-Off Valves have been standard equipment on most high pressure boilers. In fact, more than 80% of high pressure plants use Yarways.

Now a *new design* Unit Tandem is offered for *medium pressure boilers to 665 WSP.* Streamlined, lighter in weight, easy to operate, tight sealing and long wearing—this valve brings premium quality Yarway Unit Tandem dependability to the medium pressure field—*at a competitive price!*

Important features, like the nitralloy plunger in the sealing valve and integral stellite seat and disc in the blowing valve, make this your best buy for blow-off service.

Order Yarway Unit Tandems for your present boilers—or specify them on new boilers.

For full details write for Yarway Bulletin B-435, Supplement A.

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What's Wrong With Consulting Engineers?

STAFF REPORT

DISRAELI said, "It is much easier to be critical than to be correct." Still, there is much about the private practice of engineering that is not as it should be, and often those who see these faults best are not the consulting engineers themselves but the manufacturers and suppliers who deal with them.

A man (or a profession) must recognize his sins before he can stop sinning, and sometimes these sins have to be pointed out by others. With this in mind, we wrote to 200 prominent manufacturers and asked them to tell us of the faults they observed in consulting engineers – technical faults, professional faults, and business faults. We knew that no manufacturer would be willing to speak freely if it were possible to identify him. He had to remain anonymous; yet we wanted to know that all comments came from responsible persons and were not simply the railings of cranks. Therefore, we asked that all answers be written on plain paper and submitted to us unsigned, but we also asked that a letter of transmittal, signed by a company official, accompany them. We promised to separate comments from letters in the mail room so that there would be no way to tie a particular comment to a particular company. This we did.

The respondents trusted us to maintain their anonymity, so they spoke freely. Most of their criticisms are clear and to the point, and there is surprising consistency throughout, except in rare instances. Some of the complaints can be answered quite readily – they represent no more than sour grape gripes. Others are sincere and thoughtful, and well worth the full consideration of all engineers in private practice. In some instances it is clear that the consultant is being condemned for nothing more than honestly representing the interest of his client; in others, the manufacturer is giving examples of incompetent, unethical, or actually dishonest practice.

We have grouped all comments according to type. Those having to do with lack of technical competence are presented first. Next come the professionally unethical or actually dishonest cases. These are followed by examples of bad or simply inconsiderate business practices. Other than this regrouping to bring some sort of order, we have left the comments untouched. This is what the

manufacturers actually had to say, and we now let them speak for themselves without editorial comment, without any attempt to eliminate inconsistencies, and with no defense offered for the consulting engineer. The wise and the foolish are mixed together for the reader to sort for himself.

In nearly every instance the manufacturers pointed out plainly that their condemnations applied only to a minority of engineers in private practice. The manufacturers also were careful to state that most of their dealings with consulting engineers were most pleasant and that most engineers they dealt with were competent, ethical, and cooperative. There is no more indication of malpractice in engineering than there is in medicine or law, but what there is seriously damages the standing of the profession and should be wiped out.

The "Help Wanted" Engineers

¶ Perhaps no single activity has caused more friction between manufacturers and consulting engineers than the offering of "free" engineering to clients by manufacturers of equipment and producers of material. Yet, we find that consulting engineers, themselves, expect the manufacturers to furnish them with engineering design work that goes far beyond the design of the products we manufacture.

¶ Many of us have had to extend product design and development into the project development area once reserved almost exclusively for the consultant. Part of the explanation lies in current practices on the part of some consulting engineers — practices that have cost manufacturers in time and money. The demand for near complete plant or process design, along with product design details, are a double burden that all too often must be assumed by the manufacturers of major equipment items. If this practice grows, it can be expected that we will develop our own consulting services.

¶ There are certain consulting engineers who essentially do nothing but collect information and engineering service from manufacturers, put all this together, and call it an engineering job specification. Water hammer problems provide a good example. Valve manufacturers are called upon to make analyses of water hammer problems which rightfully should be done by the consulting engineer or some special consultant hired by him. As a result, the manufacturer has to assume too much responsibility, particularly with regard to valves used as pump check valves.

Industrial motor control is another product area with which many consulting engineers seem to be less than familiar. It seems they know more about switchgear than they do about industrial control. This often results in a specification written around switchgear standards even when industrial control would be much more desirable. And when the consulting engineer goes into a field in which he is not too familiar, he is quite likely to copy specifications prepared by one manufacturer, thereby making it nearly impossible for other manufacturers to bid even when their equipment is of equal quality.

¶ We notice that any number of consulting engineers rely upon suppliers rather than upon their own knowledge to discriminate between various materials and pieces of equipment. Too many times we have done the consulting engineer's work in our particular field since he knows next to nothing about the equipment nor is he in a position to judge between the various types. The client gets

from the consultant a package that consists of a vast amount of knowledge passed on as the consultant's but which in reality is the result of data gleaned from sales engineers.

¶ We have been asked occasionally for recommendations, since we are one of the several authorities in our field. While we appreciate the compliment, we deplore the idea of some consultants basing their decisions upon a popularity poll of recognized manufacturers. It would seem far better if they were to delve deeply into all facets of the problem and its possible solutions with a single competent manufacturer. The ballot box certainly does not guarantee finest engineering.

¶ If the consulting engineer firm is to be paid a fee for designing, why shouldn't the supplier of technical information be paid for consulting with the consultant?

¶ There are instances where there is a very fine line between product and project design. The materials handling field is one of these, but most consulting engineers, and most manufacturers, are perfectly conscious of their actions when they ask more than they should of the other.

The Special Design Fiends

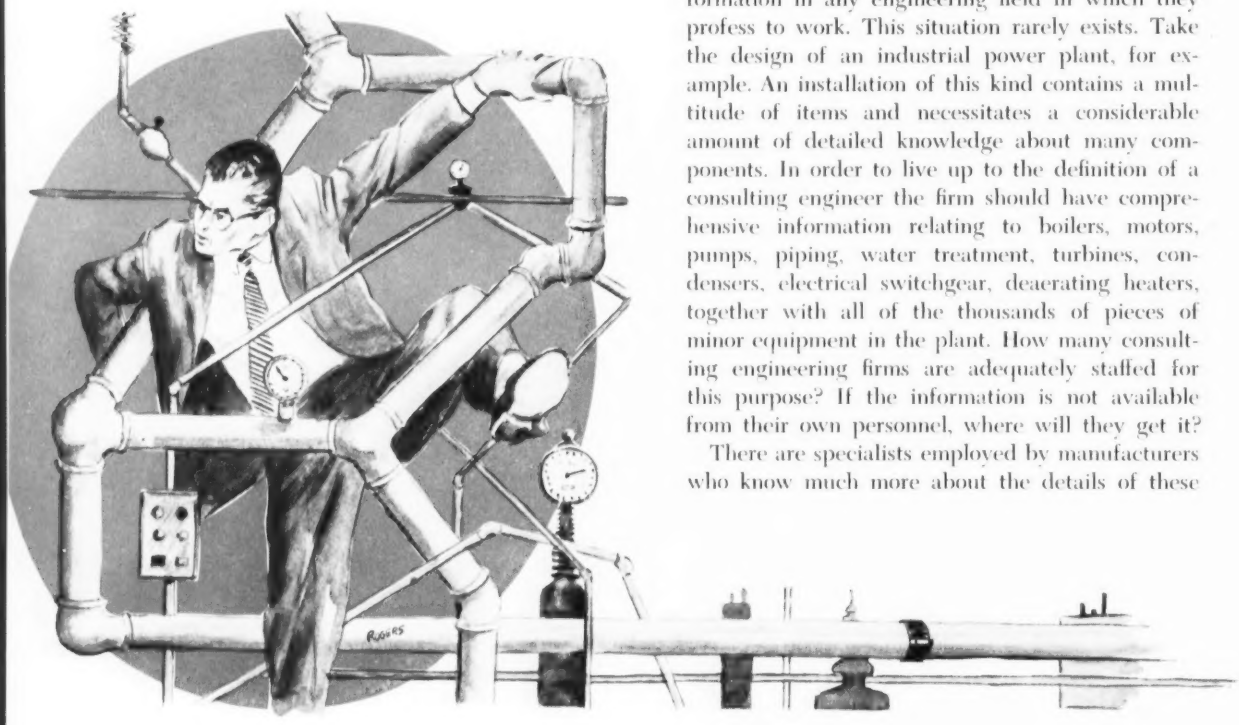
¶ There is another type of engineer who is just the opposite of the one who expects the manufacturer to do all of the project engineering. This second consultant refuses to let the manufacturer design his products. He will not specify a standard piece of equipment but must stick strictly to special designs different from anything that has ever been made before. He will use nothing but custom built equipment and thereby increase the cost of the project enormously – usually to no good purpose.

¶ We are constantly striving to improve products and make them more suitable to present-day needs and present-day systems. Engineers who devise their own special material or equipment to suit job requirements introduce problems of design and manufacture and increase tremendously the possibilities of installation and service trouble. Consulting engineers should first consult with qualified manufacturers' representatives to make sure that standard equipment is not available that would satisfy their requirements before they start designing products for us. The consulting engineer may know his subject well and his system may be a perfectly satisfactory one, but it is going to be hard on the owner when the time comes for maintenance of the system or replacement of parts.

Just Plain Incompetents

¶ Consulting engineers are incompetent in some of the fields in which they offer their services. A consulting engineer firm is made up of a group which is supposed to possess all the necessary information in any engineering field in which they profess to work. This situation rarely exists. Take the design of an industrial power plant, for example. An installation of this kind contains a multitude of items and necessitates a considerable amount of detailed knowledge about many components. In order to live up to the definition of a consulting engineer the firm should have comprehensive information relating to boilers, motors, pumps, piping, water treatment, turbines, condensers, electrical switchgear, deaerating heaters, together with all of the thousands of pieces of minor equipment in the plant. How many consulting engineering firms are adequately staffed for this purpose? If the information is not available from their own personnel, where will they get it?

There are specialists employed by manufacturers who know much more about the details of these



items than consulting engineers do. The average consulting engineer does not have and need not have the specialized knowledge our staff has. He should leave this highly technical work to us.

¶ No one can know as much about certain aspects of design as our own specialized engineering staffs know. We have very little faith in the technical competence of the average consulting engineer, and too many of them try to work in fields they know nothing about.

¶ Often, consultants fail to see the forest for the trees. They get involved in interesting details and split technical hairs over items that amount to less than five percent of the total project. On the more prosaic but larger portions of the job, they turn a deaf ear.

¶ All too frequently the consultant does not thoroughly investigate all the aspects of each item in the design cycle. The consultant is inclined to accept the word of his supplier that the equipment specified is really the proper selection rather than arrive at this decision independently based on his knowledge, training, and experience. We have even seen such casual attention to detail that fan motors were specified as a.c. while the accompanying controls were d.c.

¶ Consulting engineers load their systems with far too many controls, making them expensive to install and frequently costly to maintain. Sometimes the controls they specify do not work at all.

¶ As we watch consultants loading the system with tremendously expensive components, we cannot but wonder if the almighty dollar has reared its ugly head to the point where the consulting engineer is thinking more of his fee than he is about the good of his client. The ultimate cost of operating a system does not seem to concern consulting engineers at all. We frequently find almost double the required capacity has been specified by the consultant. For some unknown reason, consultants tend to overspecify in heating more than they do in air conditioning.

¶ Overdesign is all too common. Some consulting engineers are inclined to design as if the component had to hold up the world. On some jobs they cannot even get anyone to manufacture what they have specified. I know of a particular engineer who has done this on a certain product for years. Eight years ago, two manufacturers were willing to make it. Now, nobody will – but he specifies it.

¶ The quality of plans have depreciated as consulting engineers have developed plan factories. Sketch plans are made leaving a lot of engineering work to the contractors and manufacturers. In fact, drawings by some prominent engineering offices are extremely difficult to use even for estimating.

¶ Even when the top men in the firm are thoroughly competent, they tend to turn too much work over to the young engineers down the line who simply are not up to it.

¶ Consulting engineers should have a strong association and an enforceable code of ethics. Whenever they find an incompetent man in their midst, he should be expelled from the association. This, of course, assumes an association so strong that all consultants would be expected to belong to it. Otherwise, expulsion would mean nothing.

Poorly Written Specifications

¶ Consulting engineers write specifications in too detailed a fashion when they should simply outline functions and results and then evaluate the bids on the engineering merits of the offerings. This would permit bidders to introduce ingenuity in their designs. Thus, specifications should cover only capacity and character requirements, construction codes, operating conditions, and space limitations.

¶ Engineers appear to have an aversion to written detail, particularly on products about which they may not be too well informed. The result often is a weak specification under which the engineer may not get what he wants – controversy almost invariably ensues. Architects can and do write execrable specifications, but they are inclined in the opposite direction. Architects frequently write thousands

of words apparently dedicated to muddying the water. The end result is actually the same – uninterpretable specifications.

¶ When calling for equipment bids, the consulting engineer must prepare specifications that will protect his client's interests as to quality, performance, and economics. The consultant should not, however, proceed too far concerning construction details that may not be particularly important and certainly do not effect any of the over-all project requirements. When these specifications are detailed too far, it handicaps one or all of the equipment manufacturers and adds to the client's cost.

¶ Specifications are loosely written and engineers do not stand firm for quality products. The contractor bids on the specified equipment and then shops around to obtain a cheap equivalent. With loose specifications this can be done, and the contractor gains while the owner loses.

¶ Incompleteness, ambiguity, and even inaccuracy are rampant. But worst of all is the engineer who specifies a particular product by name and then proceeds to detail something that deviates significantly from the manufacturer's standards as shown by catalog or engineering data. The engineer invariably is appalled when informed by the manufacturer that he will not make the product as detailed or that he can make it only at a considerably higher cost. Frequently in these situations the manufacturer has quoted budget prices based on his standards. Then, when the engineer gets the word about the increased cost, his trauma is acute. I have yet to find the engineer who does not then feel abused or misused. Often the detailer's resentment will be so strong that he will thereafter be prejudiced against the products of the manufacturer.

¶ Consulting engineers should adopt a code of ethics that requires the writing of open specifications that deal only with the quality and performance of material required.

¶ The so-called open specification is most often unfair to bidders because it describes in detail equipment that any manufacturer can supply but follows the description with an unrealistic guarantee requirement. A competent engineer can best serve his client's interest by avoiding open specifications and stating clearly what he wants.

¶ Inadequate definition of the quality of the materials that are acceptable . . .

¶ Unbiddable specifications based on one manufacturer's patented design . . .

¶ Use of outdated standards supplemented by ridiculous factors of safety . . .

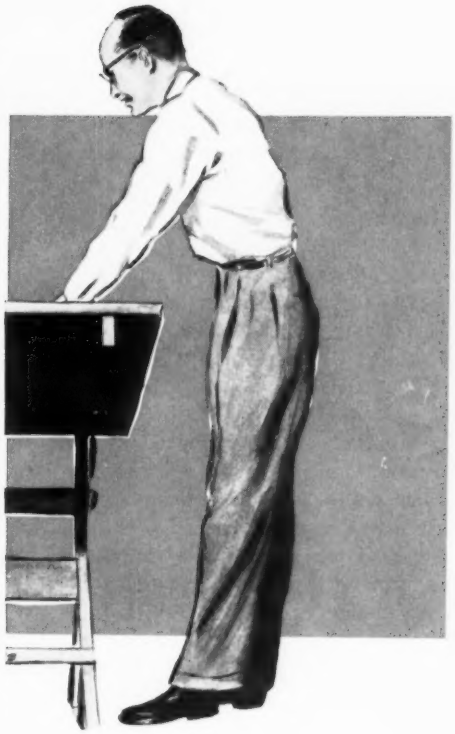
¶ Demands that separate components be "supplied by the same source" when separate sources would provide better quality for the project as a whole.

The Closed Mind

¶ Consulting engineers are too conservative and too unwilling to listen to the story of new and improved products and less costly methods of doing a job. Once a consulting engineer gets accustomed to doing a job a certain way, it is cheaper and quicker for him to continue designing in exactly the same way. He does not want to learn anything new. Many of them still are designing the same way they did 20 years ago and taking no interest in the new developments. Even those that have the latest and most up-to-date information are inclined to use a specification that has been in their files for years. Unfortunately, these "standard" specifications are not always kept up to date. Often when a specification is prepared this way, some items are so old they do not permit sensible bidding.

¶ All too often consulting engineers copy a specification from a previous job no matter how long ago it was written or how obsolete the equipment may be. They do this in order to save time instead of investigating up-to-date equipment. I found that an engineer had his plans all drawn and specifications written for some 200 apartment house mailboxes after the line had been long discontinued.

¶ It appears that many consulting engineers are not aware of latest product developments when preparing specifications. At least some specifica-



tions seem to remain standard over a period of years, despite the progress in the industry manufacturing the equipment. Apparently certain new specifications are prepared by turning over pages of one specification to a typist and having them written up for succeeding jobs even where the conditions may not be entirely duplicate. Their ideas are sometimes 15 to 25 years old. Unfortunately, some consultants assume that the various ASTM, ASA, and other standards are indicative of the latest ideas. This is by no means so.

¶ Perhaps the consulting engineer is afraid to try anything new for fear it might not work and he would ruin his reputation. This is understandable, but that is no reason for him to refuse to even look into new devices. That is his responsibility to his client. As an actual fact, it is his ultra-conservatism and his inclination to stay in a rut that results in new improvements being so slow in finding their way into the construction field.

Inadequate Supervision

¶ Engineers fail to back up their designs with adequate job supervision. This is due to their inability to sell the architect on the need for this service. They compromise their position and that of the manufacturer by leaving to an untrained mechanical contractor or to the architect's junior supervisor the interpretation of complicated mechanical specifications. Because they have minimum contact with the job as it progresses and after it is completed, they do not really learn what was wrong with the design or the application of the mechanical devices. Not until there is dissatisfaction on the part of the owner or a dispute between contractor and owner is the engineer brought into the picture. This seriously limits the value of the consulting engineer and does not enhance his prestige.

No Guts—No Backbone

¶ Apparently many consulting engineers do not have the guts to stand up for what they believe is right. As the result of pressure from clients, architects, salesmen, or contractors, they often change their specifications to admit inferior products.

¶ If you analyze the method of operation of the really high grade consulting engineers, you will find that they will not be influenced in any way that will downgrade a well engineered job. An architect and an owner respect an engineer who will stand on his two feet and not compromise himself. An engineer should have a clear agreement with his client ahead of time that he will not stand for any interference, and he must be given complete authority. If at a later date his client attempts to influence his judgment, he must refuse to make any detrimental changes even if it results in his resigning as consulting engineer.

¶ Failure to hold to specifications is the grimmest problem of all. We feel we represent high quality in our field, and it is a bitter dose to be specified and then watch the engineer accept an inferior

product because it is cheaper. I have gotten to the point where I tell them that we are happy to have them specify our products, but if they intend to accept inferior products on a price basis, then please do not specify us. We cannot afford to work for nothing. Despite this, some will go ahead and permit substitutions, anyway. One man was so flagrant in this that we not only refuse to call on him to provide assistance, but stopped bidding his jobs. He was outraged.

It is also true that this particular problem is seriously aggravated by the contractor. In his desperate anxiety to get the job, he will take a chance with a lower price, even on a qualified bid, and then pressure the engineer or owner into buying the lower priced substitute. Manufacturers and their representatives who are parties to these deals must share equal culpability with the contractor. But I submit that these practices could not exist if engineers and architects consistently did the job they were supposed to do. It is extremely discouraging to try and maintain a quality standard in the face of this growing evil. It is growing like a fast cancer. If it is allowed to continue, it will make a shambles and mockery of the specification procedure, and will bring great discredit to the private practice of engineering.

¶ The vast majority of consulting engineers with whom we are constantly in contact are conscientious and fully versed in the technology of their profession. For the most part, they recognize the quality of various manfacturers within their field. They establish these precedents in the formation of their specifications. Our chief criticism is that in many cases these specifications fall apart at the seams after the jobs are let. This is partially the responsibility of the consulting engineer. The two basic reasons for the collapse of the specification data are: the acceptance of a contractor who is extremely low on a job, with subsequent hedging on the specifications so as to prevent the contractor from going bankrupt; the other is the possibility that the job has gone over estimates, and herein the rat-race begins and so-called negotiating permits the loosening of specifications. This throws quality control out of the hands of the engineer into the hands of the contractor. Time and again we have seen this occur, and the only individual who gains on these renegotiations is the contractor himself.

¶ The worst fault one can find with consulting engineers is that when they work as consultants to architects they do not insist on the authority to be the last word on all equipment and work in their particular field. Many times the architect arbitrarily tells the consulting engineer what he should specify and how he should specify it. The consulting engineers are pushed around by the architect who controls the work the engineers do on all large commercial or public buildings.

When you consider that the consulting engineer today is responsible for the largest portion of a building, he should be responsible for the final completion of the building — not the architect. Adding up the contract price of all designs by engineers such as the structural engineer, heating and ventilating engineer, plumbing, electrical engineer, etc., as much as 60-70 percent of the total contract is the result of the engineers. Thus, it is folly for the engineer to let the architect dictate how the engineering part of the building should be designed. The architect many times also is allowed to eliminate some very necessary mechanical or electrical devices in favor of more expensive brick, marble, or some other pretty. Naturally, the engineers should insist that the owner or architect pay them a large enough fee to cover the cost of their designing, supervising, and inspecting their phase of the work on any construction project.

¶ It is unprofessional practice for a consulting engineer to accept what he knows to be an inferior substitute for materials or equipment that are clearly specified. Consulting engineers, themselves, have recognized the seriousness of this charge, and efforts have been made in some parts of the country to eliminate the evil. But too many consulting engineers are still weak-kneed when dealing with clients and even with contractors. The profession will not receive the respect it deserves until consulting engineers refuse to be bullied into changing their specifications.

¶ On occasions, the evils involved in the acceptance of inferior substitutes lead to corollary practices that are even more serious. We know a consulting engineer who regularly wrote closed specifications and then allowed them to be opened to everyone after the contractor's bid had been accepted. Another would pass bid information from one bidder on to other bidders who were competitors.

¶ There is a large consulting engineering firm that issues specifications and takes bids on equipment and then shortly after the bids are tabulated advises each salesman as to where his price was with relation to other bidders. This is obviously done simply to bring the prices down.

¶ Consultants often specify a definite quality requirement and then encourage the contractor to accept bids from an inferior manufacturer. This bid has no chance of getting the order, but the low price is used to put pressure on the actually qualified bidders. This amounts to no more than deception on the part of the consulting engineer, and it certainly represents an unprofessional activity.

Takes the Credit but not the Blame

¶ The consulting engineer wants all of the credit wherever there is any to be passed out, but then he insists on shifting the blame to someone else when things turn out wrong. The consulting engineer sets himself up as a sort of minor potentate who can never be wrong. He passes down judgments from his ivory tower and refuses to listen to anyone. Frequently he will specify a unique arrangement simply to demonstrate that he can do something different whether it is better or not.

¶ Despite the consulting engineer being so high and mighty, if the crutches of the sales engineers that support him in this lofty position were withdrawn, he would topple because his knowledge is not anything like he represents it to his clients. This does not apply only to the lone consulting engineer but also to the big companies who rely on outside sales engineers for their knowledge. Yet consulting engineers are paid a very hefty fee by the client for a knowledge they do not possess. There is a terrific amount of hypocrisy in the consulting engineering fraternity today. And the consultant refuses to ever give manufacturer's engineers credit for any of this work they have done or the technical data they have supplied.

¶ When a consulting engineer makes a mistake, he should be man enough to admit it even if the mistake has been called to his attention by a sales engineer. The proper way for this business to work is for the consulting engineer and the sales engineer to work as a team to bring all of the ideas out into the open and discuss them intelligently so that the client can get a better job at a lower price.

¶ When something really goes wrong, they want the supplier to come in and take the blame. Some engineers have compared the engineer's specification to the doctor's prescription, but the doctors only ask that the pharmacist fill the prescription accurately, they do not want a guarantee that it will cure the patient. The engineer, on the other hand, wants to shift all the responsibility away from himself and onto the manufacturer.

¶ The consulting engineer always has some excuse for any mistakes that he cannot find a way to deny. It is often that "the architect wouldn't give us enough space to do the job right."

¶ Many consulting engineers, obviously, are more worried about their own reputations than about their client's interests. This is demonstrated in the many techniques they have developed to protect themselves against their own errors. Every contractor and every equipment manufacturer knows that he is often required to be the fall guy for the engineer.

¶ With rare exception, it is not the consulting engineer who pays for the engineer's mistakes, but we must admit that architects are even worse in this respect. We have known only one architect that would take the blame for a mistake he had made.

¶ I have never seen an example of failure in which the engineer admitted that it was a matter of application rather than a matter of product quality. Sometimes the engineer will specify a piece of equipment that has no business being called upon to function in that capacity. It doesn't work, and then whose fault is it? Obviously, the manufacturer becomes the goat. If the manufacturer refuses to take the blame, he is threatened with all types of trouble. Sometimes the engineer will refuse to specify the product for years and years.

This business does not work both ways, for while the engineer expects the supplier and the contractor to cover his errors at no additional charge,

the engineer does not feel the same way when a supplier or a contractor makes an error. This is cause for suit.

¶ The thinking of some engineers in these situations I find downright incredible. The manufacturer or the contractor or both usually pay for the engineer's mistakes. Sometimes the engineer will clip the owner for an extra, but where this is not possible, he simply passes the buck down the line. In situations like that, I have been told blandly that, after all, he (the consulting engineer) had specified our products on numerous jobs from which we had made a lot of money and . . . That sentence need not be completed. This is fantastic talk from a professional man whose ethics and intelligence are supposed to be above the average. This is not only unethical, it is outright dishonest.

Favors and Kickbacks

¶ Many engineers will specify their friends' products and completely eliminate others that are equal. Sometimes an engineer has a favorite salesman or a favorite company; they get favored treatment.

¶ One of the greatest gripes that we have regarding consulting engineers is their asking for discounts on equipment – discounts which go into their own private coffers. This happens in some of the biggest firms in the country, and I am sure that it is a very undesirable practice that does not react to the client's benefit.

¶ I know of an instance in which the consulting engineer was actually paid off by a manufacturer to disapprove all equipment of their competitors.

Bad Business Practices

¶ If the manufacturer goes over the engineer's head to the owner, the engineer eliminates him from the specifications as a punishment for his action. This is not fair to the owner or the manufacturer and is very narrow-minded on the part of the consultant.

¶ The manufacturers should clear through the consulting engineer's office when he wants to call on the owner or one of the owner's men, but if the manufacturer feels that it is necessary to call on the owner for the benefit of everyone concerned, the consulting engineer should not prevent him from doing so by threatening punishment of some sort. Apparently the engineer is afraid that the manufacturer may upset the engineer-client relationship by encouraging the client to think for himself.

¶ By necessity, the consulting engineers during the course of their studies and layout of the complete plant project are dependent on the manufacturers of special equipment for general and detailed engineering information. These requests involve considerable expenditure in time for completion of the studies. In addition, time of designers and draftsmen is required to prepare the necessary layouts showing space demands and indicating how the equipment can be fitted into the over-all plans. Other items of expense include travel and time of an application engineer.

These nonrecoverable expenses of the manufacturer average several thousand dollars on a project of any magnitude. There have been occasions where the manufacturer's expenses on a single project have exceeded $25,000. But the consulting engineer does not seem to recognize the value of the services rendered. After spending large sums of money, we then lose the order on price to some manufacturer who has contributed nothing to engineering or research. In many instances these companies enjoy a much lower sales expense by virtue of not maintaining a staff of engineering specialists, and they are not subjected to any expense prior to receiving the specifications and making the actual bid. Thus, high caliber services from reliable manufacturers are penalized while the second rate, low cost supplier is favored.

¶ There are consulting engineers who will permit one highly respected manufacturer to do all the design work and then turn around and open the bidding to competitors who have contributed nothing toward the design.

¶ On a large project this prominent consultant issued specifications for equipment of the type that we manufacture, and in quoting we met the specifications exactly. During the negotiations and before the order was placed, we introduced a new and novel design of a major component for this job with the thought that we might be permitted to offer it as an alternate to our original bid. The consultant was strongly impressed with this new design but when asked if we could offer it as an alternate, he said "It would not be fair to your competitors unless we allowed them all to bid on this basis."

Since that time our company has been awarded a patent on this improvement. The point in this case is that despite the merits of the manufacturer's ideas, the consultant felt no qualms about suggesting that competition be allowed to bid on the same basis regardless of our expense for development. His whole attitude was that any manufacturer's ideas should be public property. With this attitude prevalent, manufacturers have no reason for investing in research and development.

¶ A well known consultant solicited our help in solving his problem pertinent to products manufactured by us to be used in expanding the production of a large mill. The problem was quite complex since there were five basic possibilities to consider,

each of which required detailed studies of at least four different types of equipment applications.

Our engineer agreed to make preliminary studies, and after spending a large part of his time for the next two weeks on this project, he submitted a 15-page report to the consultant which completely resolved the problem to a single conclusive solution. Upon receiving this report, for which we asked no fee, the consultant was quite pleased and stated that it was conclusive enough for him and that he would refrain from hiring outside help for this phase of the project in which he felt he was not himself qualified. This saved him and his client several thousand dollars.

He then requested that we provide him with sample specifications for the equipment involved, and in complying we made it a point that these specifications be broad enough for each bidder to incorporate his own ideas in offering his equipment. This was done intentionally, since we had features to offer in our bid which were novel and quite exclusive to our company, and we did not wish to reveal them in the specifications stage of the negotiation. He issued our sample specification practically verbatim. After submitting our bid we were surprised and shocked to learn that the job went to a low priced competitor for $2500 less than the price we quoted.

It was also learned that this manufacturer, although not originally invited to bid, chanced to call on the client during the negotiation and upon learning of the project, asked for permission to bid. Not only was he given the specifications, but he was also handed copies of our drawings, taken from our bid, showing our exclusive designs. Naturally, the competitor included them in offering his bid. This manufacturer contributed nothing in solving the problem but walked off with the order. We invested large sums in helping this consultant and got nothing for our effort. He, in turn, took full credit and collected his fee.

He had the opportunity, but made no effort to tell his client of our contribution to the job. He further disclosed our designs to low priced competition, who had no trouble beating our price because they did not have to bear the costs of the study and the research.

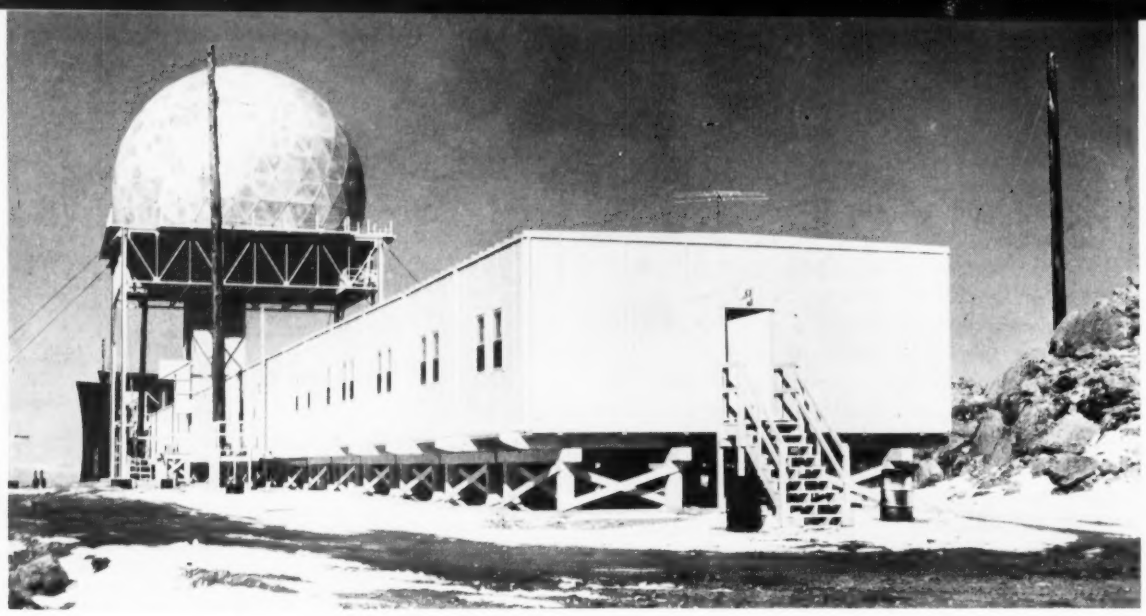
They Refuse to Listen

¶ Unless the consulting engineer is really in a jam, he is inclined to refuse to listen to the manufacturer's salesmen. Consulting engineers give the impression that they are superior to anyone who sells a product. They refuse the equipment representative an opportunity to properly present his sales story or even give technical data. In no other market can the salesman expect so much lack of consideration and so little courtesy.

¶ It is true that consulting engineers are busy, and it is true that they are called on by a multitude of sales representatives, but somehow it always seems to be the busiest engineer who gives the salesman the best hearing.

¶ Some engineering firms limit the days or half days when representatives can call on them. This may be all right in large cities when dealing with local offices, but it is unfair to refuse to see a salesman who has come from many miles away and cannot stay in the engineer's city long enough to fit into the few hours each week allowed him and his fellow salesmen. Granted, the sales representative should make an appointment with the consulting engineer before he calls, but he should not be limited to one or one-half day a week. And when he does make an appointment, the consulting engineer should keep it and should give him more than a minute or two on the telephone from the waiting room. When you get into his office, you find that he is constantly interrupted by phone calls and by office visits from others who just want to take a minute here or a minute there but manage to completely interrupt the salesman's efforts to sell.

¶ Apparently, the consulting engineer forgets that most manufacturing firms with whom they deal are also made up of engineers and that in many instances the salesmen themselves are well trained and registered engineers. Yet, the consultant tends to treat these fellow professionals as if they were pencil salesmen. Some manufacturers have found that it is necessary for them to send their top men — their chief engineers or their vice presidents — before a consultant will take time to talk. ▲▲



Stilt foundation buildings at DEW line station house the personnel, heating equipment, and the radar's electronics.

Design Problems for Consultants--

Arctic Water Supply and Sewage Disposal

STEPHEN D. TEETOR and STANLEY ROSANOFF
Seelye Stevenson Value & Knecht

A CONSULTING ENGINEER practicing in the temperate zones has little conception of the problems involved in water supply and sewage disposal in the far North. In the North as in any part of the world, quality and quantity of water available are the prime considerations. But there also are special problems, as we found when we were called upon to locate and sample water sources in winter for the DEW line installations, our early warning radar network above the Arctic Circle.

Prospecting and Sampling

The first difficulty is the location of a water source, for there is little to differentiate between a snow covered frozen pond and the adjacent shore.

Then, there is the matter of getting the samples. In early winter there is about four feet of ice over a pond or lake, and it is possible to make a hole with an ice chopper constructed with a chisel mounted on the end of a long pole. It must be kept in mind, however, that the sample must be taken quickly or the hole will refreeze into solid ice.

We took samples of water with a 1-quart can and a 4-ounce bottle. The can and the bottle, each tied to a long string, were dropped quickly through the hole in the ice and allowed to sink to the bottom. In this way the depth of the lake at that point also was determined.

On being withdrawn the string usually was stiffened by a half-inch coating of ice, and the bottle, with a small neck, almost invariably had an ice cork before it was possible to insert the glass one. To avoid the breaking of the bottle, it had to be put immediately inside of a warm pocket. Again, working as rapidly as possible, the samples were packed to withstand the cold and were sent to the testing laboratory for analyses.

We were fortunate in finding several good water supplies at convenient distances, and the laboratory results reported to us indicated that most of the water tested was suitable for drinking, cooking, washing, and heating. In determining adequacy, it was decided that there must be at least a year's supply available from the source being tested. The watershed also had to be suffi-

cient to replenish the water each year, and 30 gallons per capita per day was established as a reasonable requirement.

So far as quality was concerned, the results of the tests are shown in Tables 1 and 2. Three of the possible water sources investigated were rejected. One of these, a tidal river, turned out to have too high a saline content, while two had a higher probable number of coliform bacteria than was felt advisable.

Water Treatment

Water treatment was required. Filtration, to remove microscopic forms of plant and animal life, and chlorination, to obtain a chlorine residual of 0.4 ppm for domestic water, was suggested for all sites. In addition, where heated water storage tanks were to be installed, prechlorination to a 0.2-ppm residual was suggested to prevent slime and objectionable tastes and odor.

Where a total hardness of over 5 grains per gallon (85.5 ppm) was noted, we recommended that all water be softened by zeolite softeners to 3 grains per gallon, with heating water to be brought as close to zero hardness as possible. Where a concentration of more than 0.3 ppm of ferrous iron was found, removal by manganese zeolite filters was considered advisable. To inhibit corrosion in the heating system, treatment was specified for all waters with a pH of less than 7.0.

We also found that there was considerable variation in these waters between winter and summer, so testing kits were provided for the site personnel to enable them to determine the extent of treatment required when conditions varied.

TABLE 1 — WATER ANALYSES

Odor and Taste	None to earthy, acrid
Color	None, white, faint yellow
Total Hardness, as $CaCO_3$	4.08 to 2587 ppm
Calcium Hardness, as $CaCO_3$	Trace to 660
Magnesium Hardness, as $MgCO_3$	Trace to 1927
Carbonate Hardness	89.4 to 115.7
Total Alkalinity, as $CaCO_3$	2.5 to 360
Iron and Aluminum Oxides	0.2 to 8.6
Calcium (Ca)	35.0 to 37.0
Magnesium (Mg)	0.4 to 1.5
Sulfate (SO_4)	0.0 to 871
Sodium and Potassium, as Na	22.1 to 188.0
Chlorides (Cl)	3.5 to 7398
Carbonate (CO_3), as $CaCO_3$	0.0 to 34.2
Bicarbonate (HCO_3), as $CaCO_3$	89.6 to 120.0
Nitrogen as Free Ammonia (NH_3)	0.0 to 0.88
Nitrogen as Nitrate (NO_3)	0.0 to 3.61
Nitrogen as Nitrite (NO_2)	0.0 to 0.3
Total Iron (Fe)	0.1 to 89.0
Total Solids	82 to 14450
Ignition Loss	46 to 792
pH	6.2 to 8.4

TABLE 2 — BACTERIOLOGICAL ANALYSES

Lactose Broth, Gas Formation 5-10 ml samples, 24 hours	Negative
Lactose Broth, Gas Formation 5-10 ml samples, 48 hours	Negative
Colonies per cc sample	170 to 6000
pH	7.0 to 7.6
Appearance	Clear to light amber
Sediment	Slight
Count, Agar 24 hours, 95 F Number of Colonies per ml, 5 to 2170	Coli-Aerogenes, 48 hours, 95 F on 1 ml / on 10 mls: ⅓ Negative to ⅔ Positive
M.P.N. Coliforms per 100 mls	Negative

All except two samples appeared free of harmful bacteria and were recommended for all purposes.

Water Distribution

Several methods of water conveyance from source to point of use were studied, and recommendations were made to suit each site condition encountered. These methods were:

- Pumping water through a fixed heated pipeline from the source to storage
- Pumping water through a fixed unheated pipeline in summer only from the source to year-round storage facilities
- Hauling all of the water for a full year in summer to supplemental storage
- Hauling by trailer in summer months and heated wanigan (heated tank mounted on a sled) in freezing temperatures from water source to storage
- Hauling harvested ice to storage and thawing it for water as required
- Filling plastic bags at the water source to be hauled to the site when frozen and melted as required for use

Manpower limitations are the major deterrent in the last four possibilities. In some instances, however, these were the only feasible means of providing water to the installation sites.

The heated pipeline is the most desirable of these methods. It makes possible delivery of water all year round, and there is no danger of depleting a limited storage because of fire or other abnormal demand. An unheated pipeline, on the other hand, can be used for only about four months in this Arctic region, so the entire 12-month supply must be collected and stored during that short period.

A comparison showed that maintenance and pumping costs for the heated and the unheated

This is a dry-type toilet that utilizes an auxiliary can or septic tank for disposal of the wastes.

pipeline systems are about the same. However a great deal more fuel is required in conjunction with a heated storage tank than is required for a heated pipeline system.

A first-cost comparison of heated versus unheated pipelines (plus supplemental storage tank) shows that the heated pipeline is the more economical of the two systems up to about 4000 feet. For longer pipelines, the unheated pipeline with heated storage tank is economically advantageous.

There are, however, certain areas in which the heated pipeline is unsatisfactory. During moderate winters lakes up to eight feet in depth will freeze solid. In a severe winter an 11-ft freeze is not uncommon. Therefore, in shallow lakes it is essential to provide supplemental storage and pump only during the warmer seasons. Sometimes it will be found necessary to construct a dam, thereby increasing the depth of a lake or stream so that the heated pipeline can be used the year round.

Designing Heated Pipelines

Since the heated pipeline system seemed best in so many instances, the next engineering problem was to determine the most attractive pipeline heating systems. The steam tracer piping method makes use of a steam pipe placed adjacent to a water pipe, both then surrounded by insulation. The steam must be supplied at the installation, and must flow downhill counter to the flow of water. It is impractical to attempt to reclaim this steam, so 100-percent makeup is required. This steam must be at an initial temperature high enough to still maintain sufficient heat when it reaches the most remote point on the pipeline.

The recirculating water system uses a return line adjacent to the water pipe, both being surrounded by insulation. This method does not require preheating the pipe, for the water is recirculated continuously at a temperature sufficient to prevent freezing. This system does require a large amount of fuel, and power is important. In the event of a power failure of even short duration, no more water is available until the next summer, for there are no facilities for preheating the pipe to prevent freezing. Once there is a plug of ice formed, flow will stop until natural thawing occurs.

A third method of heating a pipeline involves winding it with electric resistance cable. This soil cable is adequate for short lengths of pipe, but it is inefficient on long pipelines. Furthermore, if trouble develops and replacement of the wire is required, the job cannot be done without removing the insulation and dismantling the whole system. This can be quite a difficult job in 30 to 40 below zero weather.

Still another solution is the use of multiple resistance units placed end to end inside of a pipe adjacent to the water pipe, again, both being covered with insulation. These heating elements currently are used for heating dams and for temperature control in some manufacturing processes. Actually, this is probably the most satisfactory of any of the pipe heating systems studied, but there is still considerable labor involved in removing any resistance units during the winter months for either maintenance or repair.

Pipe temperature also can be maintained by impressing a low voltage on the pipe itself. This causes current flow through the pipe wall and generates sufficient heat to offset losses through the insulation. The installation of this system requires electric contacts at fixed lengths on the pipe system, and a return cable adjacent to the pipe. Low voltage electric current is impressed at these points of contact. To accomplish this, a suitable transformer is required at each contact to step down the voltage. This system has been used successfully for controlling, with great accuracy, the temperature of products in long pipelines. It also has been used satisfactorily for transporting water at other Arctic or sub-Arctic network sites. For these reasons this system was recommended wherever we felt that a heated pipeline could be used.

It still remains, however, that the consulting engineer designing water supply systems in the

Arctic will find many instances in which the only practical and economical solution is the harvesting and melting of ice during the long winters.

Sanitation and Sewage Disposal

Sewage disposal is as much a problem in the Arctic areas as water supply. In the Eskimo igloo, toilet facilities usually consist of a block of snow standing close to the doorway. When the snow block becomes inundated it is discarded and replaced with a fresh block. This waste, together with all other material to be disposed of, including dead dogs, usually is abandoned on the edge of the ocean ice, where it remains frozen and usually snow covered until the spring break-up, at which time it disappears into the ocean.

With the recent mass invasion of the Arctic by men from temperate climates, most Eskimos have moved into homes of more permanent nature. Still, water supply and sewage disposal on a community basis are impractical. The Eskimo still harvests ice which he melts for water, but his toilet facilities now have developed to the use of half an oil drum placed through a hinged exterior wall into a bathroom box having a toilet seat set in the top. The method of ultimate disposal remains the same – the full drum is hauled out to the edge of the ice to wait for the spring thaw.

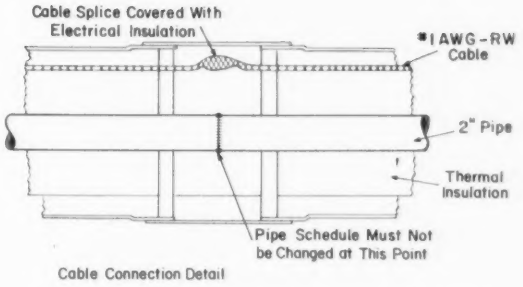
Most DEW line stations make use of hand pumped marine toilets, drawing water for flushing and discharging into the sewage collection tanks. Eskimo-type toilets also are provided as standbys against water shortages or plumbing difficulties.

In this Arctic area conventional sewage treatment methods cannot be used without the addition of considerable heat. Sewage, however, cannot become objectionable while frozen—which it is a great deal of the time. At freezing temperatures the biochemical action, whether an oxidation or reduction process, may be considered nonexistent.

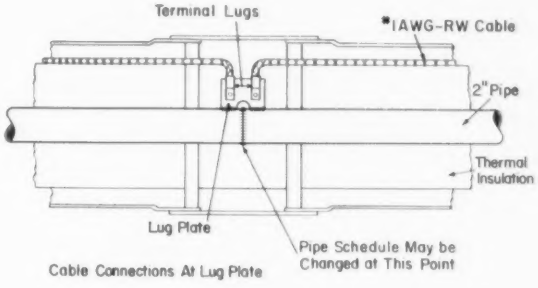
With these facts in mind, practical sewage disposal methods are, like the Eskimos', simple and direct. The sewage, while frozen, is delivered to a disposal point, where decomposition gradually takes place with the rising summer temperatures. At this point of ultimate disposal – ocean or large stream – there should be sufficient dilutions so that sewage will form a relatively insignificant portion of the volume. It also is recommended that this point of ultimate disposal be down-wind of the installation and at some reasonable distance.

The tundra is a breeding ground for insect life and is not suitable for sewage disposal.

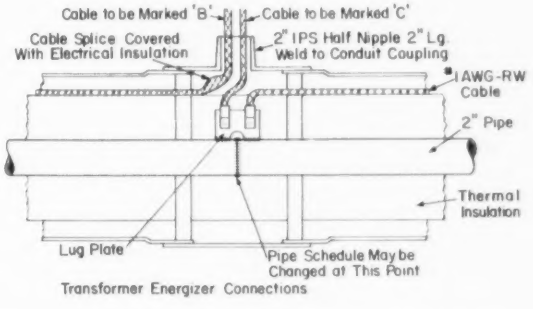
Recommended treatment is limited to chlorination of the sewage holding tanks and minimum time of storage at these points. The sewage may be conveyed to the point of ultimate disposal by a heated pipeline or by means of a heated tank that is mounted on a sled.


Cable Splice Covered With Electrical Insulation
*1AWG-RW Cable
2" Pipe
Thermal Insulation
Pipe Schedule Must Not be Changed at This Point
Cable Connection Detail

Details of the splices used throughout the system to join lengths of the electrical resistance cable.

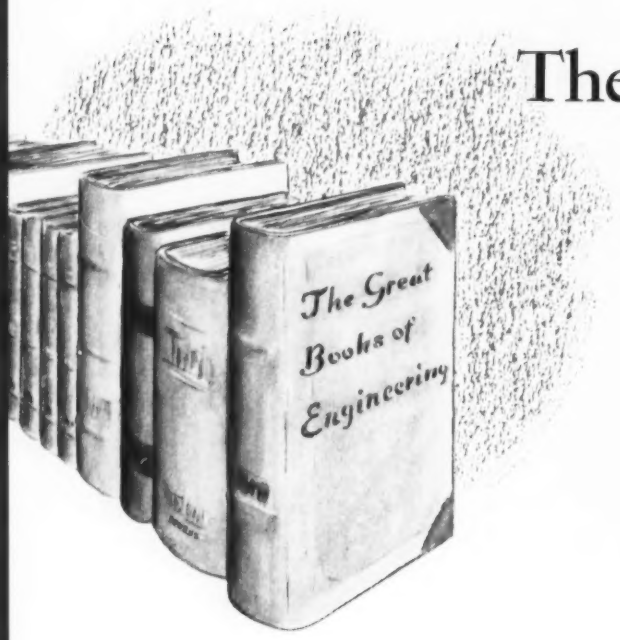


Lug plates welded to pipe at intervals provide the contacts for supplying low voltage electric current.


Cable to be Marked 'B'
Cable to be Marked 'C'
Cable Splice Covered With Electrical Insulation
2" IPS Half Nipple 2" Lg. Weld to Conduit Coupling
*1AWG-RW Cable
2" Pipe
Thermal Insulation
Lug Plate
Pipe Schedule May be Changed at This Point
Transformer Energizer Connections

Thermal electric transformer energizers with 8-kva rated capacity were incorporated in the final design.

Even today there are relatively few military installations or villages in the far north. There is, therefore, a relatively small demand for special systems and equipment designed for these conditions. However, as we begin to study and remove some of the tremendous natural resources of these nearly inaccessible areas, it will become increasingly important for consulting engineers and equipment manufacturers to study the unusual problems of these remote and frigid regions. ▲▲



The Rhind Papyrus--

Mathematics

In Ancient Egypt

JAMES KIP FINCH, Dean Emeritus
Renwick Professor of Civil Engineering
Columbia University

THE ORIGINS of the family of professions which we know as engineering date back to the earliest days of civilized life. As in other areas of human interest, engineering books have recorded the progress and accomplishments and reflected the aims and ideas of engineers throughout the 50 or more centuries of recorded history. Thus, one may follow the history of the profession by way of the great engineering books.

Expectative

From the early papyrus scrolls of Ancient Egypt, through the long centuries of later manuscripts, and on into the development of illustrations and the evolution of the printed book, engineering works tell of a profession which, always a basic factor in the rise of our western civilization, has become a major influence in our current way of life and our hopes for tomorrow.

First Engineering Classic

The first of engineering classics to come down to us dates from about 1700 B.C., but is a copy of a work of at least a century earlier. Even the older text undoubtedly summarized practices that dated from the earliest period of Egyptian history — the Old Kingdom or Pyramid Age of about 3000 B.C. Even at this early date the ancestors of both the modern architect and engineer had appeared, "he who speaks for the builder," the chief of works or master builder of the day. In fact, throughout ancient times there was no distinction in title between the architect and engineer. The early architect-engineer was an all-around construction expert also serving, when needed, as a military engineer.

Some of the methods and techniques of these early builders have been preserved for us in this first engineering classic by a scribe, A'h-mosé, who recorded them on a papyrus scroll, about 13-in. wide and originally over 18-ft long. As so often has happened, this work apparently was either mishandled by the Arabs who found it or deliberately broken into parts for sale. It has survived only in fragments, and currently even these are in different collections.

The two major parts are in the British Museum but there is also a bit in the New York Historical Society. The British pieces were bought by the British archaeologist, A. Henry Rhind, in Huxor, Egypt, in 1858, and were said to have been found in the ruins of a small building on this famous site. The British Museum reproduced them in facsimile in 1898, and in 1923, Dr. T. Eric Peet, an eminent Egyptologist, published a translation with many interesting notes. A new translation with excellent commentary was published by Arnold Buffum Chace, of Brown University, in 1927.

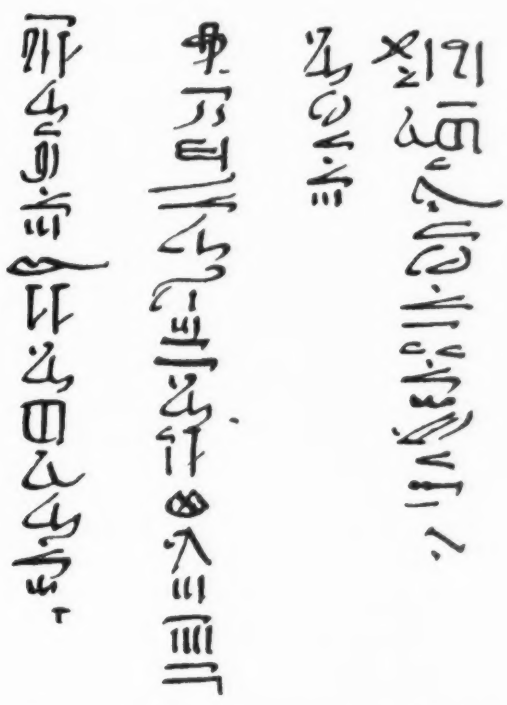
Although this work usually is referred to as "The Rhind Mathematical Papyrus," it is not a mathematical treatise in the modern sense but a book of practical rules and tables. Ancient Egyptian life

– governmental, religious, economic, and social – evolved into a set pattern and form which endured with little change throughout Egypt's long early history. Government and religion centered in the king and the priests and nobles of his court. The major undertakings were royal works, and the vast majority of a population running into the millions were simple agricultural workers. A highly organized body of royal officials directed works, collected taxes, and carried out the essential administrative tasks. The record A'h-mosé left us probably can be best described as a royal official's handbook, the forerunner of a modern engineer's pocketbook – and apparently as incapable of fitting any ordinary pocket as its modern descendant.

Practical Approach

The ancient Egyptian was an intensely practical individual and – perhaps because of the frozen

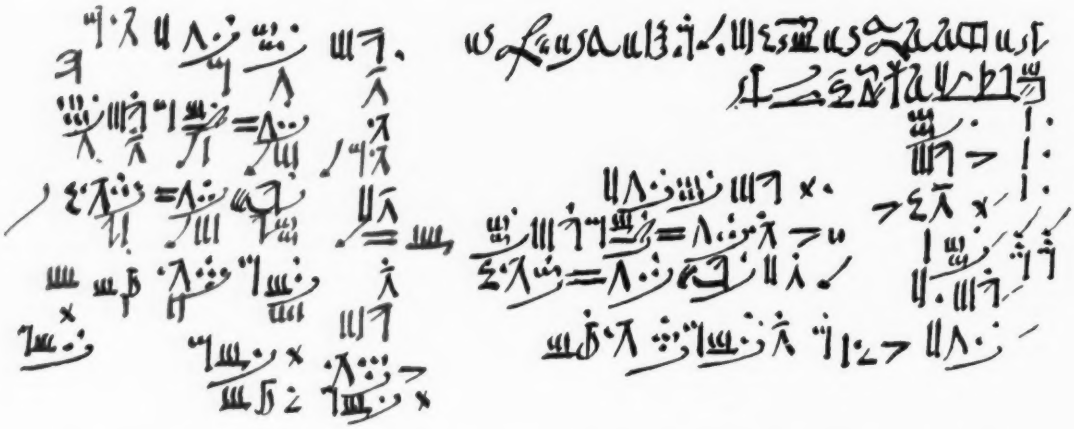
This portion of the scroll (originally about 13-in. wide and over 18-ft long) gives six problems in connection with areas. Perhaps the most interesting is (50): "Example of making a field round of khet 9. What is the amount of it in area? Take away 1/9 of it, namely 1; the remainder is 8. Make then the multiplication: 8 times 8; becomes it: 64; the amount of it, this is, in area." This $(8/9d)^2$ is equivalent to a value of π of about 3.16. Problem (49) deals with the area of a rectangle, (51) of a triangle, and (53-54) with the division of a triangle into equal areas. A khet = 100 cubits and was the linear unit, while the hekat (about 1/2 peck) was the capacity or unit of volume. (Source: Translation by Arnold Buffam Chace.)



Hieratic script reads from top to bottom and right to left. As translated this section reads, "Accurate reckoning of entering into things, knowledge of existing things all, mysteries . . . secrets all. Now was copied book this in year 33, month four of the inundation season [under the majesty of the] King of [Upper and] Lower Egypt, 'A-user-Re', endowed with life, in likeness of writings of old made in the time of the King of Upper [and Lower] Egypt, [Ne-ma] 'et-Re'. Lo the scribe A'h-mose' writes copy this." (Source: Volume I, The World of Mathematics, *James R. Newman, editor.)*

character and pressing needs of the life of his day – had no interest in a subject for its own sake. Scientific speculations were completely foreign to the Egyptian mind. This attitude is clearly reflected, as Dr. Peet notes, in the Rhind Papyrus: "Everything is expressed in concrete terms. The Egyptian does not speak or think of '8' as an abstract number, he thinks of '8 loaves' or '8 ships.' He does not work out the slope of the sides of a pyramid because it interests him to know it but because he needs a practical working rule to give the mason who is to dress the stones."

In keeping with this practical viewpoint, perhaps the most impressive feature of Egyptian mathematics is its simplicity. The numerical system was decimal, with symbols for 1, 10, 100, and on to



In Volume I, The World of Mathematics, *author James R. Newman includes this description of Problem 36 of the papyrus. "Go down 1 times 3, 1/3 of me, 1/5 of me is added to me; return 1, filled am 1. What is the quantity saying it?" In this facsimile of the problem as it appears in the papyrus, the hieratic script reads from right to left. Characters are shown in two colors, the same method used by the writer of the papyrus.*

1,000,000, but, unfortunately it was very clumsy. The intermediate numbers were formed by simply repeating these symbols. Thus, eight was written with eight vertical strokes; to write 879 no less than 24 signs had to be made. On the other hand, the Egyptian schoolboy escaped the multiplication table. Multiplying was a matter of doubling and adding; thus, to multiply 15 x 13:

$$\begin{aligned} 1 \times 15 &= 15 \\ 2 \times 15 &= 30 \\ 4 \times 15 &= 60 \\ 8 \times 15 &= 120 \end{aligned}$$

The checked multipliers 1, 4, and 8 total 13, and the sum of the products – 15, 60, and 120 – give the correct answer, 195.

Fractions

A major part of the Rhind scroll is devoted to fractions, a problem that often would arise in the assessment of taxes, the division of booty, or barter and similar transactions. Here, with the one exception of 2/3, the Egyptian never used fractions having a numerator other than unity. Thus, 4/7 would be written 1/2 + 1/14; or, if 1/11 was to be multiplied by 2, it was 1/6 + 1/66.

Yet, even with these simple rules, the areas of fields were computed from triangles and rectangles; sections were divided into equal size fields; the cubic contents of granaries were determined; and numerous other practical problems of the day were handled effectively.

One of the most remarkable rules in the Rhind Papyrus shows that the problem of squaring the circle is close to 50 centuries old. The square of 8/9 the diameter is the rule given. One can guess that it might have been arrived at by weighing circles and squares. It is equivalent to a value of π of 3.16.

Pyramid Construction

The construction survey for a pyramid was probably one of the most difficult problems the ancient builder faced. The Great Pyramid, for example, was oriented by a simple sighting of the North Star, but its base had to be started at different levels. Plummet levels would give the difference in levels, and, knowing the batter or slope of the sides, no angle measurement was necessary to compute the proper distance out at which to begin building. Right angles probably were set off using a sighting square, and distances were measured with ropes.

The accuracy secured was excellent but not beyond the possibilities of these methods. The sides of the Great Pyramid average 9069.45 inches, with a difference between the longest and shortest side of 7.9 inches, or about 1 in 1130. This could be obtained with measuring tapes without too much difficulty. The corner angles differ from 90 degrees by about 3 minutes, that is, by about 0.8 of a foot – certainly not an impossible accuracy with a simple, right angle sighting frame.

As Engelbach, who devoted a lifetime to studying Egyptian construction methods (See *Ancient Egyptian Masonry* by Clark and Engelbach), remarks, any assumption of the use of any other than the simplest methods and means by the ancient Egyptian would be completely out of keeping with the interests and ideas of the workers whose practical and effective rules were recorded by the scribe A'h-mosé in this earliest engineering handbook-scroll some 35 centuries ago. ▲▲

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The Council Steps Ahead--

Big Meeting in the Big City

STAFF REPORT

CONSULTING ENGINEERS COUNCIL, at its third annual meeting in New York City, took three giant steps toward maturity. Plans were approved for a move of Council offices to Washington, D. C., for an enlarged public relations program, and for immediate revision of the dues, membership, and organizational structure.

CE exclusive

For the first time, a Council meeting had a touch of the international, with representatives of the International Federation of Consulting Engineers (FIDIC), the Association of Consulting Engineers of Canada, and the International Bank for Reconstruction and Development (World Bank) mingling with the 100 Council delegates and observers at business and social affairs.

A further harmonious highlight was the appearance of John Noble Richards, president of the American Institute of Architects, who spoke on a popular topic – architect-engineer cooperation.

Washington Office

Most important action of the annual meeting was the adoption of the motion on moving procedures:

¶ That the executive committee is in agreement that the office of CEC should be in Washington. That the move should be made as soon as practicable, and as soon as the financial status is adequate to maintain and staff that office.

¶ That no move to Washington, D. C. shall be undertaken until the reserve fund has been built up to cover adequately any contingencies that might arise. The reserve fund at the present time is approximately $4000, and a suggested minimum reserve would be $10,000.

¶ That the move to Washington should not be undertaken until an executive director for the organization has been employed.

¶ That the executive director should be first installed in the present Springfield office and given an appropriate amount of time to orient himself in the affairs of the Council.

¶ That Larry Spiller be retained as the executive secretary charged particularly with the mechanics of operating the executive office under the guidance of the newly retained executive director.

CEC delegates were in agreement that the Council office should move to Washington. The

only questions were when and with how much expense involved.

The New York Association included in its lengthy report to CEC a recommendation that "it is vital that CEC move its office to Washington, D. C. immediately or as soon thereafter as practical, and . . . at the present level of expenditures, the CEC can afford to have a Washington, D. C. office on a modest scale."

However, the majority decided to wait until the $10,000 contingency fund is "in sight," a director is hired, and the Council can go to Washington in the style to which it wants to become accustomed.

As past president Charles C. Pate pointed out, "We're in a bureaucratic government, and the bureaus are the ones interpreting the laws. I think we should have been in Washington two years ago." But he did not want to move to D. C. until the Council is represented by a director who knows his way around in government circles.

Increased Operating Budget Needed

The Council could operate with its existing staff in Washington on its current operating budget—$58,000, or $45 per principal in the firms represented in the member associations. The expanded Washington office, with a capable executive director, would mean a new operating budget somewhere in the vicinity of $81,000, or $63 per principal. (This does not include public relations expenses.) The expanded operating budget is to be discussed again at the semiannual meeting in Cincinnati next fall.

However, in addition to present office expenses, the Washington office would involve a suggested $15,000 for an executive director's salary; $5000 for the director's secretary; and $6000 for the director's travel expenses.

President Ralph Westcott—who already is looking around for a qualified executive director—said, "We are going to move to Washington as soon as expeditiously possible, within six to nine months if all goes well."

One of the strongest advocates of the move to Washington is John K. M. Pryke, who has handled the Council's Washington liaison. Pryke said, "In the three years since its inception, CEC has grown up rapidly. If, therefore, we are to continue this growth, and properly strengthen the position we already occupy, we simply cannot afford to continue with our 'too little and too late' efforts in Washington. Currently we are not even scratching the surface. This situation must not continue."

Public Relations Program

A public relations program, costing $5000, also was approved by the Council executive committee and board. The program approved was the first phase of the graduated proposal circulated to members after the Dallas meeting last fall. Three member associations reserved the right to review the public relations program after one year, and President Westcott stressed that "the adoption of the interim public relations plan will not commit us for the $50,000 program" (included as a proposal for Council PR activities in five years).

The "first year plan," as adopted, includes:

¶ Counsel on gaining maximum effect, on a national level, in distribution of the brochure *Framework for the Future.*

¶ The establishment and operation of a consistent CEC news bureau, which will maintain a steady

EIPEL HENNESSEY RICE

ROCHE TOMAN LANDAUER WESTCOTT

flow of news stories to appropriate business and consumer publications.

¶ During the year, a minimum of four—and probably more—feature stories for publication in leading business magazines.

¶ Counsel and assistance in preparing the regular CEC publications, such as the *Newsletter,* and in providing public relations advice to meet requests from state associations.

¶ Establishment of the groundwork for future projects, such as improving relations of consulting engineers with architects, contractors, manufacturers, and material suppliers.

The public relations program cost of $5000 means $5 additional dues per principal above the $45 maximum set at the Dallas meeting. However, Westcott stressed that the $45 dues—the maximum—is for operating expenses and has nothing to do with public relations. In fact, the board was aware that public relations would be an additional budget item when the $45 was adopted originally.

As Tom Miles, the delegate from Oregon pointed out, "The Oregon Association has a $5000 public relations program — $100 per principal. Someday CEC is going to have to stand up and be counted."

In his banquet speech, Westcott also had a few words to say about $50 dues per principal. "This is less than $1 per week, less than a package of cigarettes a day, less than one cocktail or two candy bars a day. Engineers are not notoriously penurious in their social activities or in their charity contributions, and yet we hesitate to support properly the one organization which is doing more and can do more for consulting engineers than any other to promote our business and professional interests."

However, Westcott added at the board meeting the next day that it is his sincere hope this will be the last year the Council has to separate special items from the regular operating budget.

More Power for Executive Committee

Because of an expanded program and increasing membership, the Council approved a major operating change. Up to and including the New York meeting, all actions of the executive committee required approval of the board of directors. However, it was voted to delete from the bylaws the requirement that "all actions of the (executive) committee shall be subject to ratification by the board of directors."

As Westcott explained it, the board now will decide matters of policy. The executive committee will take the necessary actions to put these newly approved policies into force.

It also was decided to select the nominating committees at semiannual meetings in the future. Thus they can begin their deliberations early, and new officers can be selected by mid-February. In the discussion, Pryke pointed out that "future nominating committees can bring two or three new officers in every year. However . . . it can be a general principle not to have a complete turnover every year."

And it was voted that the Council will pay more of the expenses incurred by the executive committe in CEC activities. Westcott said, "To me it seems grossly unfair to ask a few to not only give generously of their time but also expect them to foot all of their out-of-pocket expenses on behalf of the Council and its members." So the Council voted to include in its budget "airline transportation required for the normal four executive committee meetings," plus "necessary hotel expenses."

Pate, who had some experience with the expense situation, also pointed out, "We have been able to operate principally because of the large donations of time, money, and office personnel by the interested consultants in the organization. A large percentage of their out-of-pocket expense has never become a responsibility of the Council budget. I hope that during the next fiscal year the Council will be a self-supporting organization.

"It has been necessary for the past three years for the offices of the president and the secretary to maintain extra stenographic help, at the sole expense of the officers, to perform the duties of these offices. It is believed this item should be corrected as soon as it is financially possible for the Council to assume this responsibility."

The new budget includes $5000 for extra secretarial help, necessary office supplies, and postage

Julian S. Tritton, the President of FIDIC, pointed to the mutual benefits of U.S. drive and Continental experience.

required for the president to carry out his duties in behalf of the Council.

Organizational Changes

A number of important changes in CEC structure are under consideration, including basic modifications in membership and dues assessment.

There was much discussion of "Big M" members and "Little m" members. The 24 associations in the Council are referred to as Members. The consulting engineers or consulting engineer firms in those 24 associations are members. Currently, only the Big M's are members of the Council, so the Council has a membership of only 24. But if the Little m's were made members of the Council, there would be an automatic increase in membership to about 1200—just by the stroke of a pen.

This is more important than it sounds, for such a change in membership status automatically would upgrade CEC in the Engineers Joint Council, where number of members of an association is one of the criteria for full constituent membership.

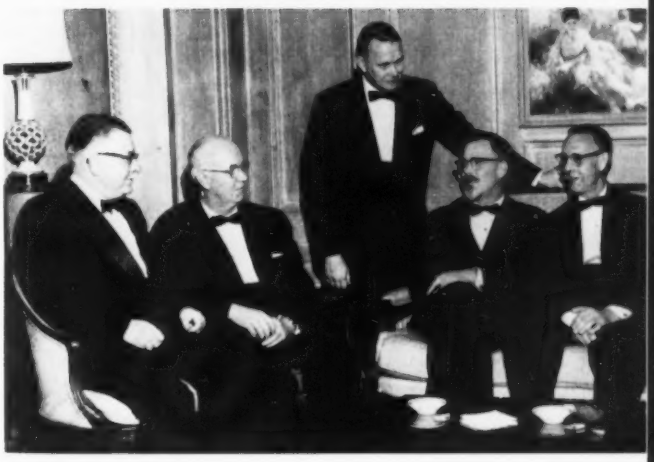
Westcott said individual membership also would give the Little m more direct participation in the Council and make him a "first class citizen." However, the matter of individual membership is not decided and will be discussed again in Cincinnati.

Discussions of individual memberships around the convention brought up an interesting possibility. What if members of a member association, in the future, disagreed on some such theoretical question as the Council dues. Could not the association pull out of the Council and let its members belong to the Council on an individual basis if they so desired?

The Council also is making a study on a possible revision in the method of dues assessment. A questionnaire is being circulated to get information on the number of employees per member firm, the dues formula of the various associations, and other data for selecting a new basis for dues.

One suggestion, by Westcott, was that dues be determined on the basis of social security payments made by the employers for employees. The New York Association, on the other hand, suggested that its sliding scale—based on the number of technical employees in each firm—works well. The New York group said this information could be considered along with the number of consulting firms represented by each association to determine final dues. "It is also strongly recommended that the 1959-60 CEC dues in no case exceed the 1958-59 dues. Any additional income necessary should be from an increase in membership," the New Yorkers added.

Westcott said, "There has been much discussion as to where additional funds should be derived—whether they should be through an increase of membership or an increase in the per capita dues. The two cannot be completely divorced since an increase in membership will be largely dependent upon the accomplishments of the Council which makes membership that much more desirable."



Phillips, Pate, Eckerlin, Miles, and Westcott, plus Besch (not shown) are the CEC officers for the coming year.

Four New Member Associations

And speaking of membership . . . Four new associations were accepted as members at the New York meeting. They are the Montana Association of Consulting Engineers, the Consulting Engineers Society of Greater Pittsburgh, the Consulting Engineers Institute of Wisconsin, and the Florida Association of Consulting Engineers.

The membership committee added that "at least 10 associations should be inducted into the Council by December of this year . . . By continuing the current program on an augmented basis, the Council soon should be truly a national organization of engineers in private practice."

Membership-at-Large

In line with the growth program, a committee was named to study the membership-at-large potential.

New York City was mentioned as a possible source of future members-at-large because the New York City Association, itself, is pretty well limited to firms in interprofessional practice. However, the New York group felt differently. Its report to the Council included the statement, "We endorse the establishment of individual membership status in areas where there is no member association, and this is desirable as a temporary expedient. However, where an association exists, it is obviously desirable that all local consultants

join them. The rules for member associations should, of course, still apply."

Proposals on FIDIC representation and expenses were referred to Cincinnati for further discussion.

The Council also adopted a policy on corporate practice. It is against the registration of corporations, per se, for the practice of engineering. But it is not against engineers incorporating in order to practice engineering "provided that the ownership and continuing control of activities . . . are carried on by professional engineers legally registered under the laws of their respective states."

The Guest Speakers

Guest speakers, at the Council's luncheon and banquet, presented the viewpoints of FIDIC, the AIA, and the New York City Buildings Department.

Julian Tritton, who is serving his second four-year term as FIDIC president, remarked that some of his fellow members had expressed surprise at the rapid growth of CEC. "But I am one of those who believe that we won two World Wars by a combination of American drive and Continental experience. I am equally confident that these same two factors will operate to our mutual advantage now that CEC has joined FIDIC."

Tritton added that as of this year, FIDIC is truly an international – rather than a Continental – group. The four new members are Canada, Australia, South Africa, and the United States.

FIDIC's International Conditions of Contract, which has been translated into French, German, Spanish, and Arabic, was cited by Tritton as one of FIDIC's finest accomplishments to date. ("I think you will agree that to obtain agreement among some 26 nations on such a controversial subject was no mean task.")

The importance of the Conditions is that it lays down in precise detail the "CCC Relationship" – client, consulting engineer, and contractor. Tritton pointed out that the consulting engineer is "the middle C," which is the right place for an impartial arbitrator between the other two.

Richards, the first AIA president to appear at a CEC annual meeting, discussed architect-engineer teamwork. "In a small way you and we began – perhaps belatedly – a few months ago when you of the Consulting Engineers Council and we of the AIA started to get together. The job requires teamwork. We require specialization. But no specialized profession can do it alone."

He explained that, "The scope of your Council, the high professional standards to which you aspire, give us the feeling that our two organizations talk the same language."

Cautioning against squandering effort in too many directions, Richards said, "It is for this reason that we of the AIA welcome the fact that you have seen fit to join the Engineers Joint Council."

(Earlier, Pate had announced that the CEC has been invited to have a member sit with the AIA on the EJC-AIA Joint Committee. As an affiliate member, CEC has not been invited to have a representative on the EJC side.)

New York City Buildings Commissioner Peter J. Reidy also spoke to the CEC luncheon. Reidy, a president of the New York Association of Consulting Engineers prior to his resignation last October when he was appointed Commissioner, said if consulting engineers throughout the nation would pay more attention to the budgets and other problems of buildings departments, there would be less criticism and better working relationships. "If the buildings departments don't function, you don't function. It would open avenues of competition you never have experienced," he added.

Other guests of the CEC were Gail Hathaway, consultant to the World Bank and former president of the American Society of Civil Engineers, and C. C. Parker, president of the Association of Consulting Engineers of Canada.

CEC has been asked to send a representative to the Canadians' annual convention in June, and also, Pate has been asked to speak at the annual meeting of AIA this summer.

Other Developments

Other developments at the annual meeting include:

Treasurer–will move bookkeeping functions to the Council offices in Springfield.

President – will be responsible, according to the revised bylaws, for suitable liaison with the presiding officials of other organizations with which the Council should maintain rapport.

Sites and Arrangements Committee – will be appointed to prepare a brochure setting forth standard convention procedures, including a basis for site selection and the duties of the host association and the Council.

Free Engineering – is a thing of the past; it now is "concealed cost engineering." Westcott says more emphasis is to be put on round-table discussions with responsible trade organizations, and "when the Council is to take official action, every attempt will be made to act with responsibility and tact on all occasions."

Chamber of Commerce – membership is being obtained by the Council. This is in the hope that there will be closer cooperation on future U.S. Chamber of Commerce policies on matters affecting the consulting engineer.

Land Surveyors – reference to the inclusion of land surveyors as members was deleted from proposed bylaws revisions. ▲▲

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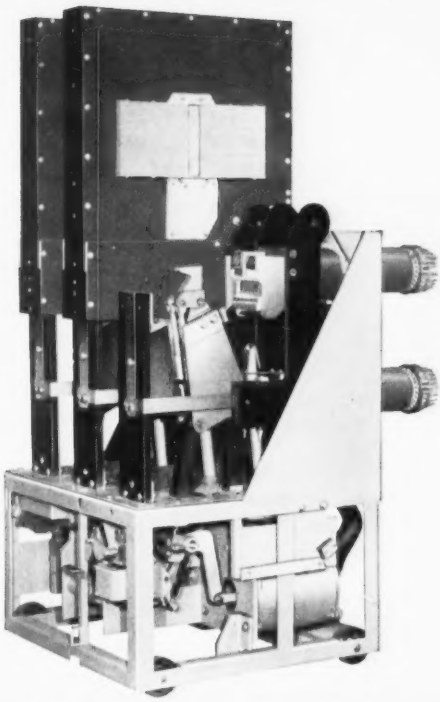

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Architectural rendering showing proposed arrangement of Golden Triangle shopping center, Mt. Dora, Florida.

Engineering Is More Than Design--

On Shopping Center Projects

ARTHUR M. SELLS II, Chief of Client Relations
Rader and Associates

Arthur M. Sells II received a Bachelor of Arts degree in Economics from Princeton University and a Bachelor of Laws degree from the University of Wisconsin. While enrolled in the Law School, he completed all the work necessary for a Bachelor of Business Administration in Accounting, and also received a Masters of Business Administration in Finance. Before joining Rader and Associates as chief of client relations, he was a member of the Bond Department of Northwestern Mutual Life Insurance Company, a vice president of the First Research Corporation, Miami, and a vice president of Mead Carney and Company, New York.

SHOPPING CENTER development continues and the more important sites are being put to use, leaving available only the marginal areas, which require thorough site research and analysis.[1] This research includes not only the architectural and engineering aspects but also those of economics and finance. These nonengineering studies are being assumed by professional engineering firms through economic research divisions set up in addition to the regular engineering departments.

By making available a complete service, a consulting engineering firm is able to show clients substantial savings in development cost. If this part

of the work is done well, the firm then will be in the best position to secure the actual engineering and design of the project.

Steps in Shopping Center Development

As defined by the Community Builders' Council,[2] the term shopping center means "a group of commercial establishments, planned, developed, owned, and managed as a unit with off-street parking provided on the property (in direct ratio to the building area) and related in location, size, and type of shops to the trade area it serves." This standard now is accepted by architects, engineers, market analysts, developers, and planners.

While shopping centers vary in type, consideration of certain basic steps is required in the development of any project:

¶ Market survey and economic analysis
¶ Selection and analysis of the site
¶ Preparation of preliminary site plan
¶ Lease negotiation with key tenants
¶ Negotiating permanent financing commitments
¶ Revision of the preliminary plans based on the key tenant leases
¶ Preparation of the final detailed architectural and engineering plans
¶ Negotiation of leases for smaller stores
¶ Letting construction contracts
¶ Supervising construction
¶ Arranging for management and maintenance

Preliminary Survey and Analysis

The market survey and analysis, the site analysis, and the preliminary site plan are the subject of a single report that is a necessary prerequisite to the subsequent steps. This report should be rendered before actual acquisition of the property, for it may bring an end to the development, thus saving a great deal of time and money.

In most instances, however, the report is an incident after the fact, for it is after the purchase of the property that the owner, developer, promoter, or real estate agent realizes that he is going to need a consulting engineer. Even then an unfavorable report can turn the land to more suitable use. The fact that many shopping centers over the past five years have become successful has not always been due to any great amounts of research and planning. Luck and exceptional population growth have sometimes helped.

The procedures used in making an economic analysis of a site are so well documented that they do not need repeating. The economic portion of the analysis takes into consideration, but is not limited by these factors:

¶ Analysis of the general area in terms of buying power, economic strength, industrial growth, and the past, present, and future population and income
¶ Determination of the trading area
- Distance from major population concentrations
- Analysis of road and highway nets and their traffic patterns, including driving time
- Existing and expected future competition
- Breakdown into primary and secondary areas

¶ Analysis of the trading area
- Rate of population growth and the expected growth trend
- Effective buying income of residents in the trade area
- Distribution of retail sales and projections
- Buying habits of the existing population
- Amount of retail business which may reasonably be expected to be attracted to the center

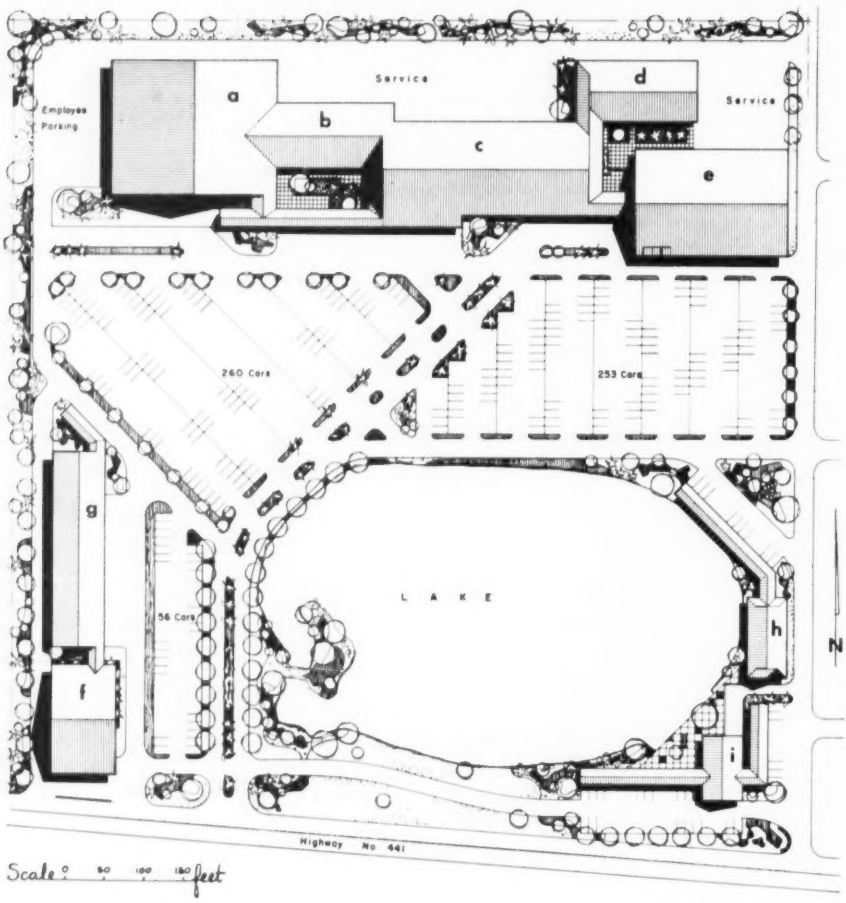
¶ Description of proposed center
- Most desirable store types
- Over-all size of center; breakdown by store type
- Estimated annual rentals per square foot for the various store types
- Any other qualitative or quantitative factors which may develop as a result of the survey.

One of the more difficult problems that confronts the analyst is that of measuring the extent of the trading area. Because there are no precise boundaries involved, one of the most frequent errors of the owner-developer is that of overestimating the trade area. This problem is particularly acute where the property has already been purchased by the client before a market analysis has been made. His preconceived ideas are seldom as conservative as they should be.

It is during this initial phase of development that the engineering firm, and its economic analysts, come under the most client pressure. It must be kept in mind, however, that while underbuilding to market demand can be as disastrous as overbuilding, it is the unbiased opinion of the professional engineering firm that will carry the most weight with the real estate managers of the national tenant groups and with the mortgage loan officers of major financial institutions. Word of an unfavorable report travels fast, and it is of little help to either the developer or to his professional reputation. On the other hand, if the result is affirmative, it cannot help having influence on prospective tenants and mortgage lenders. It should be kept in mind, however, that both of these groups maintain analytical staffs and always make an independent evaluation for their respective purposes.

Site Analysis and the Preliminary Plan

The second section of the initial report must include a detailed analysis of the site, an architectural rendering of the site and rental plans. In this section, the site under consideration is carefully



After the market has been carefully analyzed, a detailed site study is made and a site plan is prepared to meet requirements set up by the market study. Diagram shows arrangement proposed for Mt. Dora Center.

			Gross sq. ft.
BLOCK **a**	1.	Super Market	22,000
b	2.	Hardware	3,000
	3.	Shoe Repair	650
	4.	Dry Cleaning Pick-Up	800
	5.	Barber Shop	800
	6.	Beauteria	1,800
c	7.	Drug Store	6,000
	8.	Liquor Store	2,000
	9.	Men's Wear	3,000
	10.	Women's Wear	5,000
	11.	Family Shoe Store	3,000
	12.	Jewelry Store	2,000
d	13.	Books and Gifts	4,000
	14.	Sewing Machine Center	1,500
e	15.	Variety Store	16,000
f	16.	Auto Parts and Accessories	7,000
	17.	Gasoline	----
	18.	Other	1,200
	19.	Savings and Loan Association	2,000
		Sub-Total, Immediate Construction	81,750
g	20.	Future Expansion	10,000
h	21.	Future Offices	5,000
i	22.	Future Restaurant	4,000
		Total Rental Area, Full Development	100,750

Gross Area, Shopping Center	(21.8 Acres)	948,480 sq. ft.
Lake Area	(5.2 Acres)	227,500 sq. ft.
Net Area	(16.6 Acres)	720,980 sq. ft.
Ground Area Covered (Blds. and Walkways)		135,800
Gross Rental Area (Full Development)		100,750
Gross Parking Area		493,380
Parking Ratios		
Actual Number of Parking Spaces		682
Cars per 1000 sq. ft. Rental Area		6.8
Sq. ft. Parking Area per sq. ft. Rental Area		4.9

described as to its outline, size, and topography, and generally as to its relation to the surrounding area. Where applicable, a land use and zoning analysis is helpful. A traffic study may be necessary to determine whether automobile movement in the anticipated volume can be handled properly.

Shopping centers need the same utilities as any business district, and the consulting engineer must work closely with all parties concerned so that utilities will be provided at costs that can be justified. Therefore, the availability of water, gas, sewers, and electricity must be surveyed, and the conditions under which they will be installed must be considered. Placement of buildings in the preliminary plan will be based on the results of the preceding research and analysis and will be determined by the findings of the economic analyst, the engineer, and the architect.

Before any preliminary layout can be made, the developer of the proposed shopping center must decide what he wants. The arrangement of the buildings can follow one of several different pat-

terns, each of which has its own distinct advantages and problems. The site plan is affected by the topography of the land, the location of the highways, the access and egress of traffic, the size and shape of the parking area, the problems of receipt and delivery of merchandise, the appearance from the street, the protection of the shopper during bad weather, and the landscaping and decorative features that make the center more than just a collection of stores.

During this preliminary phase, and throughout the entire development program, constant attention must be directed to control of the over-all cost. Every expenditure must be examined with these thoughts in mind:

¶ Will it pay?

¶ Will it bring in enough customers to justify the expense that will be involved?

¶ What will it do to over-all cost?

¶ Will it give a proportionate investment return?

The basic problem in development cost control is to keep it low enough so that first rate merchants, both national and local, can be attracted by a lease rate low enough to make a profit for themselves and at the same time give an excellent return to the basic investors in the development. It is also important that the engineers receive fair compensation for their time and effort, but it is equally vital that these professionals are not the only ones to profit by the development. A successful development is the best way to advertise, and to be successful, each development must fairly compensate the owners and investors. Therefore, it is the duty of the consulting engineer to earn his fee by pointing out and initiating savings in every phase possible.

Merchant Selection and Lease Negotiation

In a consulting firm, the economist and the engineer can render invaluable assistance to the client during negotiations with key tenants in two ways.

The selection of tenants begins with the final determination of the total sales the shopping center can expect from its trading area. This information is contained in the preliminary economic study. Based on this information and previous experience in shopping center development, the staff economist should be able to advise the client which national chain stores would be best for his development and often will be able to provide actual contact with the real estate departments of the merchants selected.

Then, the engineer, architect, and economist must work with the tenant to advise him as to the special store features that are acceptable and the terms he can expect.

The engineering firm must be informed on current developments among the various national chain stores. One of the best ways to accomplish this is to maintain contact with the real estate managers of the several national chain stores in the different store classes. Knowledge of the individual stores, their operations, and the types of developments each is interested in, and the areas in which they are most active is extremely important in attempting to achieve an economic and merchandising balance for a development. Personal contact with the various real estate departments will allow the consultant to direct the client to those stores that will show the most interest in the project.

Recommendations Will Be Studied

Almost without exception, the major chain stores (those whose credit ratings will generate borrowing power in the money market) maintain real estate departments. It is the job of these departments to seek new locations. They also study all locations suggested to them for consideration.

Professional real estate agents who specialize in chain store leasing can be of considerable help to the owner-developer who does not want to take an active part in the negotiations. When a realtor or other professional leasing agent obtains and actually delivers a signed lease which is substantially in accordance with terms set forth by the owner-developer, he indeed has earned his fee. Often, cooperative realtors will spread their commissions out over the term of the lease, take their fee in stock of the developing corporation, or even reduce the commission in order to get a signed exclusive on the entire center. However, as long as the success of the over-all development is the primary concern of the owner-developer, negotiation of key tenant leases should be personally supervised whenever possible.

Correlating Building Requirements

The other area in which the consulting firm can render assistance during the leasing phase is in reviewing the building specifications which become a part of the lease. With the really strong national tenants, there is relatively little that can be done, for their building requirements have become almost standard and are based on a great deal of experience in many locations. Experience has indicated, however, that many of the specifications are not as rigid as they at first appear. Reasonable substitutions and variations can be made if they result in construction cost savings and do not materially affect construction quality.

The consulting engineer "will be amazed at the immense amount of time he or his staff will spend on leasing activities. He must see that the costs to the owner are reasonable, that extravagant tenant demands are resolved intelligently, and that a pre-

determined quality and performance standard is maintained. There is often a wide variance between figures wanted and features acceptable."[3]

Negotiation of Permanent Financing

In order to finance and construct a shopping center, certain minimum rentals must be obtained to make the development financially feasible. There are several instances in Florida at the present time where shopping centers could not be developed beyond the leasing stage because leases were made and recorded with minimum rentals that were not high enough to generate sufficient financing. A financial institution makes a first mortgage loan on a shopping center on the basis of firm minimum rentals from national tenants. If these minimums are not high enough to provide the proper leverage, the equity investment will be too large in relation to the expected net return to be worth the time and risk involved.

After the initial contacts are made with selected key tenants, and after the developer and his consultants begin to see a definite leasing pattern appear, contact should be made with several institutions experienced in shopping center finance. General conferences can be held with mortgage loan officers or regional representatives. Application to companies that maintain regional or local offices staffed with salaried personnel can mean substantial savings in comparison with those institutions that require application through loan agents or commission brokers. However, many large and reputable insurance companies deal only through authorized loan agents, and some of these agents, because of their many years of experience in the field, render a valuable service. Nevertheless, the savings realized by dealing direct usually will more than equal the entire consulting fee for the preliminary report.

Terms of Lease Are Important

Firm commitments for financing are based on an established percent of appraised value – subject to satisfactory title, leases, plans, and specifications. One of the more difficult problems is that of obtaining the leases in a form that is satisfactory to the lender. Some national tenants continue to make leases year after year with terms which are, and always have been, completely unacceptable; and year after year counsel for the lending institutions return these same leases as unacceptable for their purposes. The one lesson to be learned by all of this is never to have a client sign a lease until it has been approved by his lender. To do so may put the client in an extremely poor bargaining position should changes be required later. When this happens, work on the entire development can be held up until a new lease is negotiated and agreed to by the lessee.

While national tenants have been very cooperative in agreeing to changes, it still puts them in an advantageous position to require additional concessions on the owner's part. Failure to agree to changes in a valid lease will prevent the lessor from dealing with other competitive tenants until a release is accomplished. A lease unacceptable to a lending institution has no borrowing power, and a lease with no borrowing power is of little help in shopping center finance.

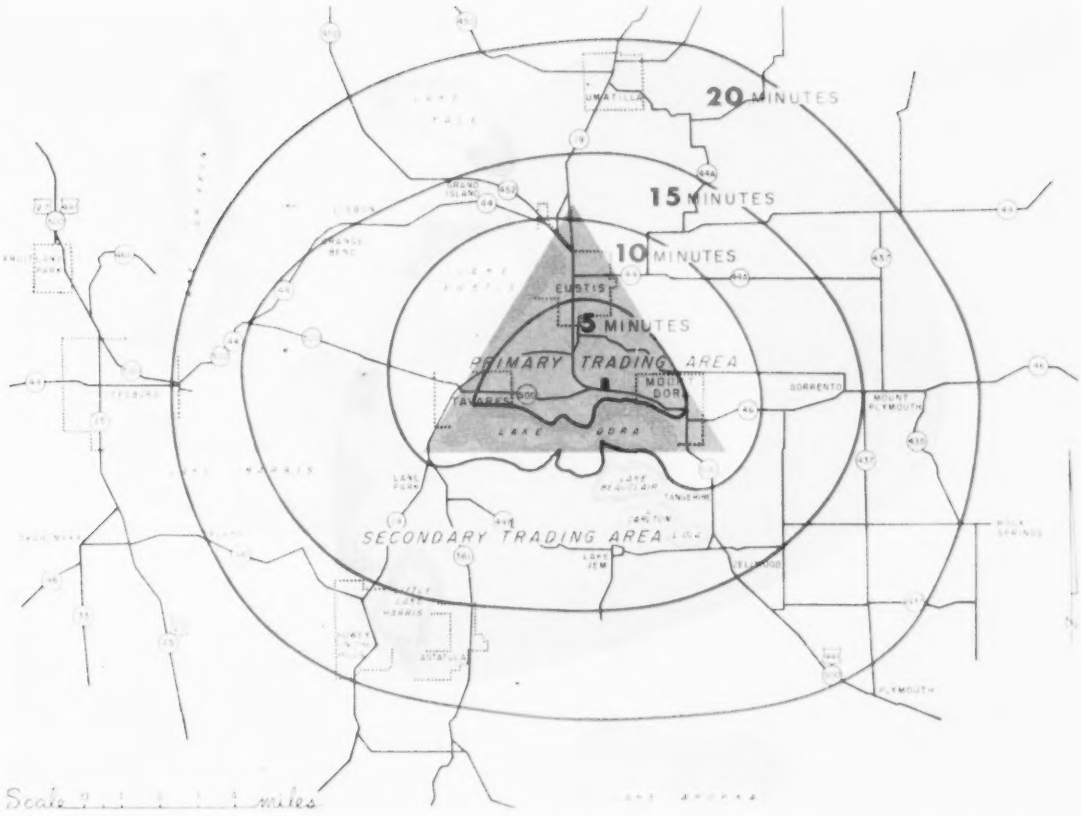
Borrowing Power of a Lease

After a lease has been submitted in satisfactory form to a lending institution, the borrowing power is directly related to the annual gross return of the lease. Annual gross return is the product of the annual square foot rental times the number of square feet leased to national tenants. Assume, for example, a square foot rental of $1.25 with 20,000 square feet available. This results in an annual gross of $25,000. This gross then is adjusted for all operating charges, including taxes and insurance. The debt service on the required loan should not exceed this net amount. As a rule of thumb, on a 15-year lease, a multiplier of 10 will indicate the approximate amount that can be expected from the gross – in this case $250,000.

Loan Based on Appraisal Value

The total amount of the loan will be based on the appraised value of the proposed development, subject to the ability to repay it from income on national leases. The appraisal must be rendered by an appraiser recognized by the lender. While the science is a complicated one, it works like this: the value of the national tenants less a vacancy factor (approximately 4 percent during the life of the buildings) plus the stabilized values of the local tenant leases (less vacancy factor of approximately 10 percent) will give a gross effective income. Operating costs including depreciation are deducted to yield an effective net income. This effective net then is capitalized, the actual rate depending upon the ratio of national to local tenants. The total loan cannot exceed a legal limit of this appraised value. For New York companies, the limit is 66 2/3 percent; in New Jersey companies the limit is 75 percent; other states vary according to their laws.

The commitment will vary within these legal limits–depending on many factors, including conditions in the money market–but the amount of the loan still is determined by what the national tenant minimum will cover. The lending institution of good reputation does not want to own the



Driving times from the surrounding area are a basic factor in defining a shopping center's trading potential.

shopping center—a default is both expensive and embarrassing to all concerned.

Details at Local Level

The remaining steps in shopping center development fall into the classification of engineering and architecture, with the exception of negotiating leases with the local tenants and arranging for the management of the center. In local tenant leasing, it is suggested that this be put into the hands of a local realtor, based on terms previously established by agreement between the owner-developer and the consultant. The local realtor is best equipped to handle this type of work, and unless the owner-developer wants to act as coordinator, an exclusive contract basis is recommended.

In setting up the management of the center, and in arranging for maintenance procedures, the professional engineering firm can be of additional help. Standard maintenance procedures can be recommended, and the accounting system should be set up to provide for proper depreciation and amortization, this being done in cooperation with the permanent manager or some accounting firm.

As the population continues to grow, and regardless of population movements into or out of urban areas, demand for the design or redesign of shopping centers will continue. While the large regional centers are the most spectacular projects and receive the greatest amounts of publicity, the neighborhood or convenience center will continue to be developed. These latter developments, along with the medium size or community developments, will continue to provide a substantial amount of income for many consulting firms—and it is at this level that the consultant can render his greatest service. The firm that can render the most complete and efficient service will continue to play a major role in shopping center development in our expanding economy. ▲▲

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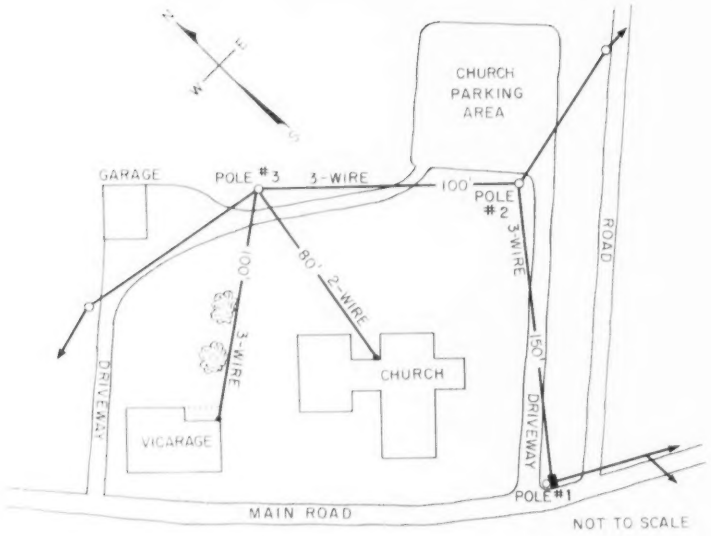

Fig. 1—Plan view of church property with one-line routing of 3-wire secondary services from a 4600/240/-120-v transformer on top of pole #1.

Arsonist on the Premises--

Fire Hazards of Flexible Armored Cable

ROBIN BEACH, Robin Beach Engineers Associated

Robin Beach is one of the country's outstanding authorities on electrostatic hazards. As head of his own consulting firm, he spends most of his energies investigating fire and explosion hazards, and as a result, frequently serves as an expert witness. Beach also is well known as an educator, having been head of the electrical engineering department at Brooklyn Polytechnic Institute for 25 years (he still holds honorary status on the staff), and concurrently for 11 years the director of education for the Brooklyn Edison Company and the Consolidated Edison Company of New York. He served on President Truman's Steering Committee which organized the President's Conference on Occupational Safety, and he remains a member under the Administration of President Eisenhower. Beach also is consultant to the New York State Society of Anesthesiologists, National Fire Protection Association, and several industrial companies and associations. In addition, he is a fellow in AIEE and AAAS, and a senior member of IRE.

IN SEARCHING FOR THE CAUSE of innumerable "mysterious" fires, I have found, many times, that they could be traced to the overheating of flexible armored electrical cable. Actually, this kind of cable is a safe, inexpensive, and convenient electric wiring for small buildings if it is installed and maintained properly and no more is demanded of it than it is built to take. It becomes a dangerous fire hazard only when it is overloaded or improperly grounded, or when it is so old that the rubber insulation around the conductors has deteriorated. Under those conditions it can be guilty of arson.

Characteristics of Cable

Flexible armored cable is properly designated, by the Underwriters Laboratories and the National Electrical Code, as Type AC Cable. It has become more generally but less properly known as Type BX, but this is a manufacturer's registered trade name. The most common sizes of this cable use No. 14 (for branch circuits with an NEC allowable fuse rating of 15 amperes) or No. 12 (for 20-ampere circuits) rubber insulated conductors.

This insulation should, under the Code, be able to stand up to a test of 1-million ohms, but test and inspection usually is limited to a new building, and in time the insulation will deteriorate and permit current leakage from the conductor to the flexible armor and thence to ground. This leakage current, once started, accelerates the failure of the insulation through localized heating. The condition spreads until it eventually attains short-circuit magnitude and may culminate in a fire.

Of the many fires I have studied that were started by overheated flexible armor, three cases illustrate the common ways in which the trouble comes about. It will be clear to a consulting engineer that these case histories demonstrate the necessity for careful design and specification that will make it unlikely that these faults could occur. It is impossible, of course, for the consulting engineer to eliminate the possibility of dangerously stupid modification of the system after it has been turned over to the owner, but he should make it hard for those who take over to endanger themselves through ignorance. In inspecting older systems, the consultant always should be on the lookout for overloading, deteriorated insulation, and improper grounds.

Case 1 — The Church Fire

A church property in a country community was supplied by a single phase, primary, 4600-v distribution line from a pole transformer, which provided 3-wire, 120/240-v electrical service to several neighboring homes as well as the attractive, well-built church and vicarage. One night the church was completely destroyed by fire and the basement of the vicarage was filled with smoke from charring wood panels which supported the main switch and fuse box, the distribution boxes, and the interconnecting and radiating armored cable circuits.

After an examination of the premises about two months later, the reasons for the fire were found. The system neutral wire crossing the back yard of the vicarage (see Figs. 1 and 2) broke where it had been weakened by rubbing against tree branches during many windstorms. The weatherproof insulation on these old service lines had deteriorated badly. When the break of the neutral wire occurred, a 40-ft section toward the vicarage curled around the upper live wire, which caused the lights, the oil burner, and the other electrical equipment to go off and on in the vicarage during the early evening hours. The other end of the broken ground wire harmlessly curled itself around the utility company's service pole without making contact with either of the live wires.

Within the basement of the vicarage, the system and apparatus ground wire, which was connected by a collar clamp to the water pipe from a well, was so badly corroded that it merely dangled loosely. A motor-driven water pump, connected in series with the water pipe, was wired with a short length of flexible armored cable running from the fuse and switch box to the motor. The flexible armor and the water pipe effectively grounded the energized neutral wire, while the intended ground wire was ineffectual and useless.

When the vicar entered the dark basement after the smoke had alarmed him, he was amazed to find that a 10-ft section of flexible armor was red-hot. He immediately opened all switches at the service and distribution boxes, but the armor still remained red-hot because of the current passing through it from the live neutral. The vicar then removed all fuses but, of course, this served no purpose, so he threw water on the charring and burning wood panels and luckily prevented the spread of fire in this location.

In the meantime, his wife telephoned the fire company and the power company for help. She then learned that the fire company, previously notified by neighbors that the church was on fire, already had dispatched equipment to the scene.

But help came too late; the church, just 200 feet away, burned down. An underground water pipe

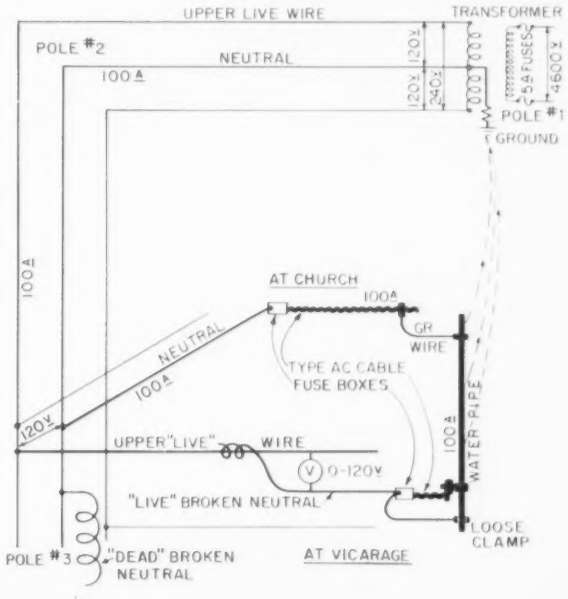

Fig. 2—Energized broken neutral wire in vicarage yard caused fault current to start fire from resulting red-hot flexible armor in basements of the vicarage and the church.

from the vicarage to the church had a ground wire connected from it to the flexible armor of a long electrical branch circuit that practically encircled the basement of the church. Hence, from the time the system neutral wire broke in the yard of the vicarage, electric fault current had flowed through this flexible armor in the basement of the church. This long section of cable was heated to a red-hot condition like that in the vicarage — a situation which promptly started a widespread fire throughout the church basement.

It is interesting to note that neighbors in their homes, located around the area of the church property, observed no disturbances of their electrical facilities sufficient to attract attention throughout this entire evening period. When the power service men arrived at the vicarage, they promptly cut the service wires entering the church and vicarage property, thereby saving the vicarage from further hazards of fire.

Negligence Inferred

The negligence in this church fire stared with the power company in permitting untrimmed trees in the yard to interfere with their wires serving the vicarage. Also the power company was negligent in permitting the insulation on the outdoor wires to deteriorate practically to the state of bareness.

Conditions in the basement of the vicarage also might be attributed to negligence. Shortly before the fire, the heating system had been converted to oil firing. The electrician who installed the wiring for the burner should have been sufficiently interested in the welfare of his customer to have investigated the condition of the system and apparatus grounding wire and its attachment to the water pipe. Finding the collar clamp corroded and loose, he should have replaced it with a substantial ground-clamp device.

As to the church proper, the insurance underwriters should have made periodic inspections, which would have resulted in the issuance of a violation for the ground-wire attachment from the far end of the armored cable to the water pipe. Where an isolated water-pipe system interlinks the electrical grounding of neighboring buildings, the electrical system and the apparatus ground should be connected by substantial clamping devices only at the service entrance.

Conclusions

Subsequently a study indicated that the fault current in the flexible armor was approximately 100 amperes, which was insufficient to blow the primary fuse at the pole transformer. This high fault current gave rise to a temperature in the flexible armor of about 1500 F, enough to develop a brilliant "white-hot" glow and to ignite the dry wood within three minutes. Even a fault current of 70 amperes would create a red-hot condition within a period of five minutes.

The time-temperature relationships for ground-fault currents passing through the flexible armor of No. 14 cable is illustrated in Fig. 3. Curves for No. 12 armored cable would be nearly the same. The hatched area labeled "Ignition Threshold" provides a vitally important fire hazard criterion. The indicated temperature span (between 190 F and 212 F) is the probable range of the auto-ignition threshold of heat-conditioned wood as found in ordinary building construction. This auto-ignition data was reported by the Underwriters' Laboratories of Chicago, in 1940, and was based on findings from tests at a property where fire had started from autoignition of wood flooring in a storeroom on two occasions within 60 days.

Electrical Fires in Two Homes

A quite different case shows how a power line fault caused one house to burn to the ground

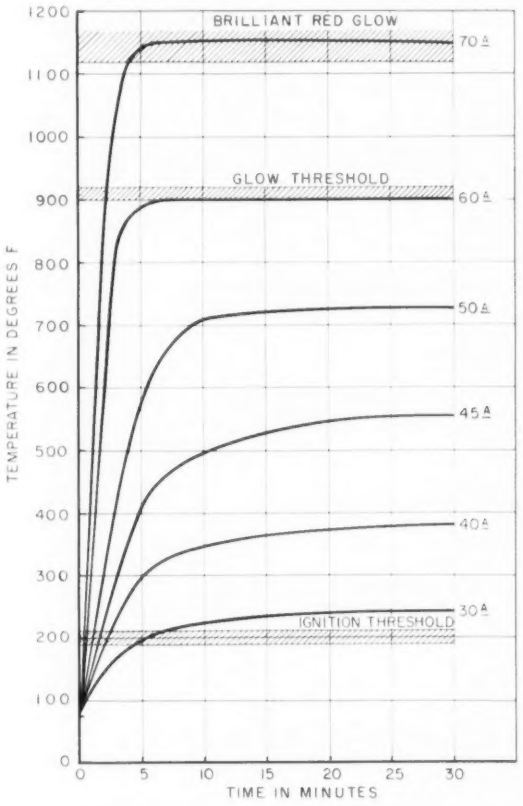

Fig. 3—Time-temperature characteristics of exposed flexible armored cable carrying indicated currents.

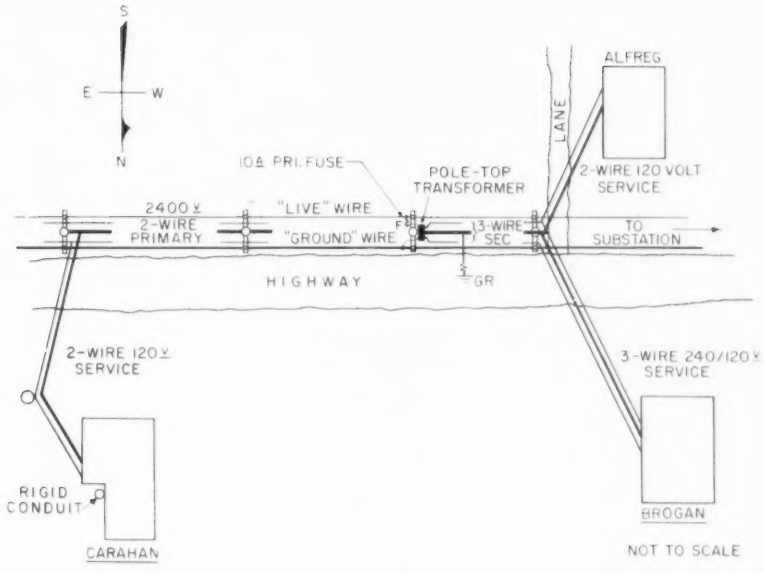

Fig. 4—Plan view of three country homes served by 3-wire secondary distribution from pole-top 2400/240/120-v transformer.

while a neighboring house was saved only by prompt and intelligent action. Both fires resulted from the failure of a pole transformer serving three neighboring properties. The house that burned was owned by a Mr. Alfreg. Another property, owned by Mr. Brogan, was located directly across the street; and, the property of Mr. Carahan adjoined that of Mr. Brogan, these two houses being about 400 feet apart. (Note: All names are fictitious.)

A single-phase, 2400-v primary distribution line which supplied this three-consumer neighborhood was connected at a substation some four miles away to a 3-phase, 4150-v, solidly grounded wye power system. The 2-wire, 2400-v distribution line consisted of a ground wire and a live wire. The ground wire was additionally grounded along its route at intervals of about one-half mile. Each of these grounds consisted of a wire from the overhead ground wire to a pipe at the base of the pole.

The geographical and electrical layout is illustrated in Fig. 4. The circuit diagram of Fig. 5 provides a sketch of the primary line, the transformer, and the secondary distribution system which supplied the homes of Messrs. Alfreg and Carahan. Since no fire occurred on the property of Mr. Brogan, no reference is made to his property on this diagram.

A failure of insulation occurred in the transformer between the primary and secondary windings causing an unbalanced difference of potential, V_f, between the primary ground wire and the secondary ground wire. This fault condition caused current to flow between these two system ground wires, as indicated in Fig. 5 by the long curvilinear

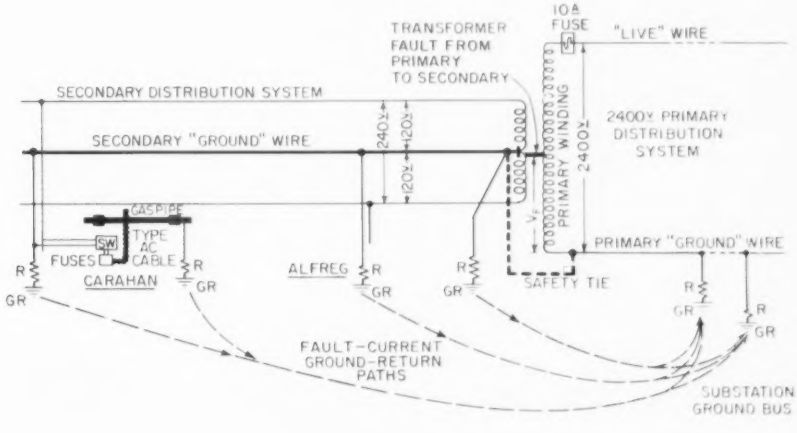

Fig. 5—Transformer fault energized the secondary neutral wire with respect to ground, causing heavy current in one section of cable armor in Carahan and Alfreg homes. Armor became red-hot and started fires in both houses.

dashed lines extending from the secondary system grounds back to the primary ground wire and the substation ground bus.

The transformer fault occurred on a Sunday noon while the Alfreg and Brogan families were at church. Mrs. Carahan heard some unusual, loud humming noises coming from the kitchen wall which continued for about 20 minutes before she finally located their source — the watt-hour meter attached to the outside wall of the kitchen. Here the power service wires came down from their insulators at the eaves of the house through a ¾-in. rigid steel conduit, through the meter, and by service entrance cable into the basement. A bare ground wire extended from the meter and connected with a pipe-driven ground directly below it.

On re-entering the house, Mrs. Carahan opened the door to the basement and discovered that the area below was filled with pungent smoke. She hurried outdoors and called her husband and son. First, they telephoned an electrician to come at once, then Mr. Carahan and his son went downstairs and found their way to the electric service entrance. Here they saw a red-hot, 20-in. section of flexible armor of a branch circuit. Clouds of smoke billowed from the wood panel against which the armored cable was tightly pressed by a recently-installed gas pipe. They pulled open the main service switch and found this to be of no avail. Then, with a long screw driver, they attempted to remove the fuses. While doing this they were alarmed by the occurrence of sparks whenever the screw driver happened to make contact with the grounded fuse box. They located a pair of rubber-insulated pliers and used these to remove the fuses. To their amazement, the metallic armor still remained red-hot.

In the meantime, Mrs. Carahan in the kitchen had her attention directed to the home of Mr. Alfreg, the rear of which was then in flames. The electrician, when he arrived at about this time, suggested cutting the incoming power wires at the eaves, which Mrs. Carahan accomplished alone with the aid of a ladder and an ax. The three men, after throwing water on the then burning wood panel above the red-hot section of armored cable in the basement, hastened to the home of Mr. Alfreg, carrying portable fire extinguishers. But they arrived too late for such trivial means to be effective; the house burned to the foundations.

Path of Fault Current

A subsequent investigation then revealed that the fault current through the secondary neutral wire at the watt-hour meter on the Carahan premises divided, a small part of it going directly to the relatively high-resistance driven ground. However, the major part of the current passed into the service boxes in the basement, through the short length of flexible armor, and thence to the low-resistance ground provided by the gas pipe.

The electrician, who was called by Mrs. Carahan, had stopped first at Mr. Alfreg's home when in passing he saw smoke coming from the rear of the house. On finding no one home, he entered the house and found that flames already were in full progress on the wall surrounding the service equipment in the kitchen. He tried to draw water to fight the fire, but the electric pump would not operate as the electrical system had become inoperative as a result of the melting of circuit fuses by the fire around the service boxes.

It later was ascertained that one of the water pipes in the basement had made contact with a long section of armored cable from the distribution box. The fire was believed to have started near the service equipment where some of the flexible armored cables were secured tightly to the pine backboards by metal straps. The current in the well-grounded armor of one of the cables where it contacted the water pipe may have been about 75 amperes, which would have caused the armor to become red-hot in a matter of three or four minutes.

Cause of Destruction

The destruction of the Alfreg house apparently resulted from the plumbing contractor's negligent and careless installation of the basement water pipes, for the piping system had been installed after the electric system.

The home of Mr. Brogan, across the street from the Alfreg house, also could have burned down at this time, but he, fortunately, had no improper and faulty connections in the wiring of his house.

The serious fire hazard at the Carahan house, which certainly would have caused the house to burn down had the family not been home, resulted from the negligent installation of the gas pipe which crossed and pressed firmly against the flexible armored cable. The plumbing contractor, or the serviceman of the gas company who installed the piping so negligently and improperly, was culpably remiss in exercising his important responsibilities to customers.

Equalizing Ground Wire is Safety Precaution

In all three of these homes, the potential fire hazards attending this transformer failure could have been eliminated by a substantial ground-equalizing wire connected between the primary and secondary ground wires. This safety connection is illustrated in Fig. 5 by the heavy dashed line labeled "Safety Tie." If this equalizing ground wire had been present when the fault developed, then the short circuit within the transformer would have

caused the primary fuse to blow almost instantly, thereby safely de-energizing the secondary system.

The Hotel Fire

Several years ago, a fire occurred in an isolated building of a large sprawling resort hotel in the eastern United States. The building served as an employees' barracks, mostly for female help. The fire started about 5:45 a.m. on a Sunday morning in midwinter. There were about 40 persons sleeping in the building at the time, almost a third of whom were burned to death. Those who escaped were so shockingly injured by extensive third-degree burns, broken backs and limbs, and permanent mental collapses as to raise serious doubt as to their good fortune in escaping.

The wiring in the building consisted of several circuits of No. 14 and No. 12 flexible armored cable which had been in service about 12 years. The hotel electrician stated he had been in the employees' barracks only twice during the entire 12-year period. It was brought out in testimony during the trial that the fuses in the distribution boxes blew repeatedly because the circuits were overloaded. The electrician stated that only 15-ampere fuses were used, but there was no qualified supervision in the building, so this statement can be given little or no credence. Doubtless 30-ampere fuses were used and even these were repeatedly blowing. It was stated that electric irons of 100-watt rating, electric heaters of 1320 watts, hair curlers of 400 watts, portable sewing machines of 250 watts, portable radio and TV sets of 75 to 250 watts, toasters of 1000 watts, coffee percolators of 1000 watts, hair driers of 750 watts, vacuum cleaners of 500 watts, and other appliances were used, singly and in multiple, in many of the rooms.

No inspection of the remains of the fire was possible, since the debris was promptly cleared away on the day following the fire. It was effectively and astutely disposed of in view of the inevitable court cases which were anticipated.

Tests of Heating Characteristics

About two years later, I was employed as an expert witness for the several law firms representing the estates of the deceased and the many plaintiffs who were injured in the fire. In developing the technical data for the trial, many enlightening tests were performed on No. 14 and No. 12 armored cable for the purpose of ascertaining and revealing their heating characteristics under various conditions of overload and insulation deterioration.

The overheating of the armored cable at an early hour on Sunday morning, before the occupants would normally arise, was believed to be caused by completely deteriorated insulation on the wires of at least one of the branch circuits which had been subjected to repeated cycles of abusive overloading from the use of 30-ampere fuses.

When insulation of basically hydrocarbon-rubber composition deteriorates to the point at which it becomes partially conductive, its carbonaceous residuum singularly is dependent for its current conduction on the temperature. When cold, the deteriorated insulation may reveal high resistance, even into the megohm range; when hot the insulation resistance may drop to a dangerous level.

In this rooming barracks the walls were constructed of plywood, separated by and secured to 2″ x 4″ wood studding. The building had a ladder fire escape at the back end of the hallways from the three floors, but the rooms were not equipped with conventional anchored rope fire escapes for egress from windows. In addition, no portable fire extinguishers were available, nor were any piped water sprinklers provided. The frame building was a fire trap for the hapless employees.

The armored cable was routed within the wall partitions through holes in the 2″ x 4″ wood studding for baseboard electrical outlets and, similarly, through the rafters between ceilings and floors to provide ceiling outlets for lighting in the halls and rooms. Heating of the building was provided by a steam boiler, which was oil-fired and thermostatically controlled. The windows were covered on the outside by substantial metal mosquito screens, permanently nailed directly to the window frames.

Electrical Hazards Causing Fire

Electrical heating tests were conducted on 15-ft lengths of old type No. 14 and No. 12 type AC armored cable at their rated currents of 15 and 20 amperes, respectively. Some shrouding of the cable was used to simulate the restricted cooling within the studding of the building walls, especially where the armored cable passed through holes in the 2″ x 4″ stud supports for the plywood partitions with only a 1/16-in. clearance.

Data from the normal loading tests of No. 14 and No. 12 armored cable are presented graphically in the lower two curves of Fig. 6. From an inspection of these two curves, the temperature of the cable is seen to rise very gradually and level off at a conservative and completely safe value with respect to the ignition-threshold temperature shown for dried-out wood. These curves clearly demonstrate the safety of armored cable when it is used properly, as intended, and when it is fused in accordance with NEC specifications.

On the same figure, two curves provide data for the same cables under identical conditions of restricted heat radiation and convection when both the No. 14 and No. 12 armored cables carry the

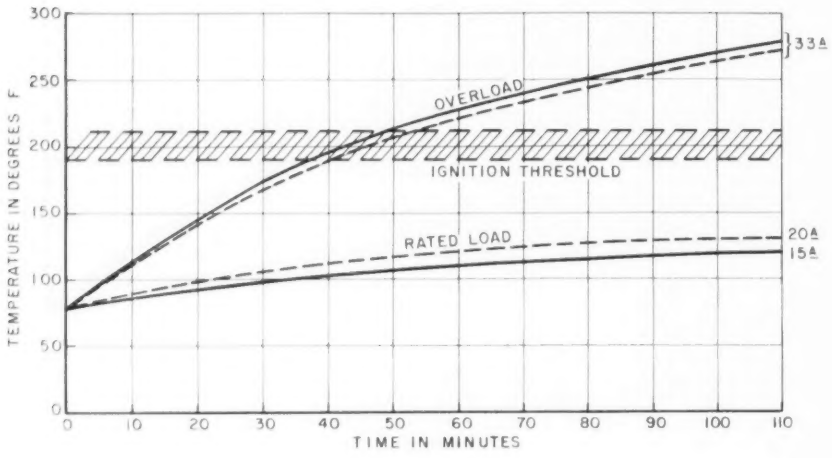

Fig. 6—Temperature curves for shrouded armor of No. 14 cable (solid lines) and No. 12 cable (dashed lines), with conductors carrying rated & overload currents.

same maximum current for 30-ampere fuses operated at 10 percent continuous overload. Here it is seen that the temperature of the armor not only rises rapidly but attains dangerously high values well above the autoignition threshold for dry wood.

In Fig. 7, the heating of the armor on this old-type cable was caused by passing the indicated currents through one wire of the cable in series with the flexible armor. The parts of the curves for No. 14 armored cable at 33 amperes and 27.5 amperes rise at a steeper rate above 300 F and 420 F, respectively. The breaks in the rise of these two curves occurred during the tests as a result of autoignition of the temporary wood and fabric structures used in the tests to simulate conditions within the wall partitions. The temperature curve for No. 12 armored cable at 27.5 amperes as shown by the dotted line, on the other hand, rises smoothly without any break in the time rate of heating by providing an improved air-convection shrouding.

A study of these curves in Fig. 7 leads to the significant and important conclusions that both No. 14 and No. 12 armored cable, when fused to standard fuse ratings above those recommended by NEC, and carrying current 10 percent above these fuse ratings, can cause the temperature of the armor to rise well above the ignition threshold for dried-out wood. Note also that even the curves representing only rated fuse currents plus 10 percent for No. 14 and No. 12 armored cable exceed the ignition threshold for dry wood, with No. 12 armored cable at 22 amperes (lower dotted line) being particularly hazardous.

These situations are analogous to those which exist where leakage or ground-fault currents pass from the live wire through excessively deteriorated insulation on the wire into the grounded armor. Such a perilous situation is believed to have existed in one long circuit of armored cable during the early hours preceding the fire in the barracks.

Additional Tests

For the purpose of ascertaining the magnitude of the leakage current from the conductor through excessively deteriorated rubber insulation to the armor, additional electrical tests were conducted. The data from these tests revealed several significant findings relating to hazardous conditions which occur in grounding of the armor at the service boxes. Grounding resistance of the armor at the service box in the low order of approximately 5 ohms is required for maintaining the control of current to the values of 25 to 30 amperes in the armor resulting from short circuits between the live wire and the armor. This order of resistance is inadvertently introduced by inadequate grounding attachment of the armor to the metal of the service boxes.

The older types of connectors for attaching flexible armor to service boxes employ steel castings containing threads on one end with a lock unit provided to secure the attachment into punched-out holes in the steel outlet box. On the other end of the attachment, a rigid collar contains a screw by means of which the end of the armor is secured within the collar to provide grounding contact for it with the grounded service box. The better modern types of armor connectors are of pressed steel construction provided with threading on one end and an improved locking nut. The end receiving the armor is equipped with a split collar held with two screws which clamp the armor to the grounded service box.

Any experienced and observant electrician knows that the screws holding the armor into contact with the grounded service boxes may, and commonly

do, loosen from vibration. The loosening is aided by the expansion and contraction cycles of the armor from its repeated heating and cooling. A loosened and possibly corroded contact between the armor and the grounded service box can account for the controlling resistance that limits the short-circuit current to 25 or 30 amperes without blowing a 25- or 30-ampere fuse in the live wire of the armored cable.

Temperature Rise is Rapid

Where the lay of the live wire within the flexible armored cable yields extensive contact with the armor along its length, and the rubber insulation on the wire and the paper wrappings are quite thoroughly carbonized from frequent overheating by an overfused circuit, even the leakage current may approach that order. Current of the maximum value of 30 amperes through the armor, even in open freely radiating space, raises its temperature to the ignition threshold of wood in less than five minutes. At the end of 30 minutes, the temperature attains a value of 242 F.

A fault situation in the armor from its inadequate grounding at the distribution box, causing controlled leakage or short-circuit current in a long armored cable, undoubtedly was responsible for starting and so extensively spreading the fire throughout the employees' barracks at the hotel.

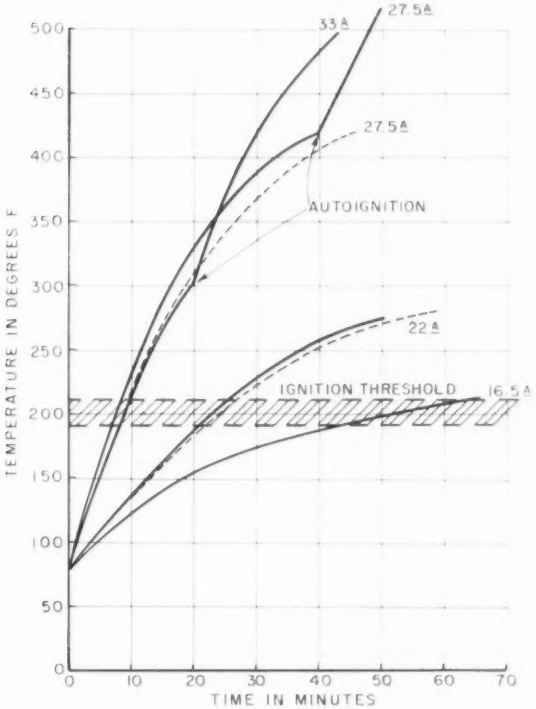

Fig. 7—Temperature curves of No. 14 (solid lines) and No. 12 (dashed lines) shrouded flexible armor when carrying currents of indicated magnitudes.

Inferences and Conclusions

The potential fire hazards from overfused armored cable is especially emphasized by the two upper curves of Fig. 6, which show the autoignition of dry wood can occur in only 40 minutes of operation for No. 14 and No. 12 armored cable at 10 percent overloading of 30-ampere fuses. To protect distribution boxes from being tampered with, the doors should be provided with locks in large establishments so that only the building superintendent and his trained attendants have access. In homes or small commercial or industrial establishments the NEC wisely has provided for the use of Type S plug fuses whereby dangerous overfusing can be effectively prevented and safe refusing may be handled by anyone. Prominent labels should be posted inside the doors of fuse boxes stating the fire dangers of using fuses over 15 amperes for No. 14 cable or over 20 amperes for No. 12 cable, and specifying the size of fuse for each circuit.

The uncertain state of deterioration of the insulation can best be determined by appropriate electrical tests of the branch circuits from time to time. Testing the insulation resistance by megger is a quite satisfactory and convenient method, provided the testing is conducted by someone experienced in such measurements and the tests are performed when the insulation is hot. However, when the deterioration of rubber insulation approaches its life span, then fire hazards may arise as shown by the curves in Fig. 7.

Thermoplastic insulation, which now is being used extensively in certain areas of electrical service, is not without its drawbacks. Up to a characteristic and critical temperature approaching their melting points, thermoplastic insulations generally maintain their solid state, their high electrical resistivity, and their excellent dielectric properties. But, when the flow temperature of the thermoplastic is attained, the insulation cleanly melts away from the copper, leaving the bare wire exposed to the occurrence of electrical faults without any prior notice of the completely deteriorated state of the insulation. The condition may not be known until an electrical fault occurs, throwing the circuit out of service.

On the other hand, when rubber insulation is overheated, even in the early stages an arrestingly malodorous smell is emitted. This warns of approaching electrical trouble. Subsequently the wiring with its injured rubber insulation may withstand the vicissitudes of continuing service until its replacement can be executed. ▲▲

Engineering Geology Evaluation - -

For Preliminary Planning And Site Selection

ALLEN H. NICOL
Consulting
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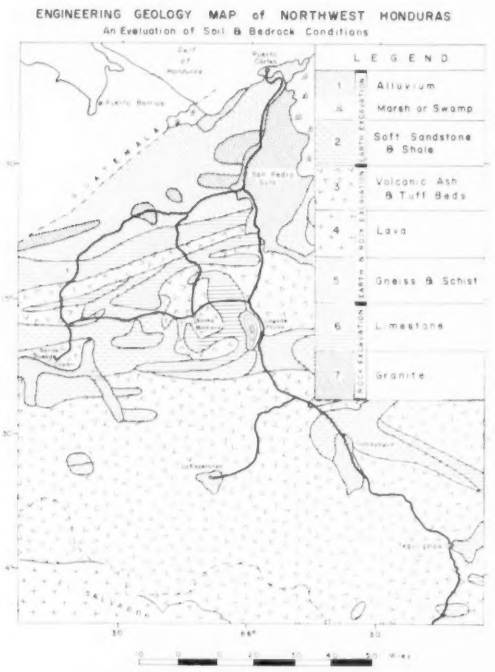


Fig. 1—Distribution of seven different types of soil and bedrock, with their excavation characteristics.

MANY CONSULTING ENGINEERS have found it useful under today's competitive conditions to explore in greater detail their project areas prior to preliminary planning. Since the basic soil and bedrock conditions of any project area have an important bearing on the final site selection, feasibility, and cost, the engineering geologist is increasingly called on to supply geologic information during the research phase.

Exclusive

Until recently most of these geologic investigations were made for final design and were based largely on detailed field exploration.

Scope of the Study

There is, however, a more rapid approach by which much needed geologic information can be given the engineer for preliminary planning, by means of a quick, generalized interpretation of the soil, bedrock, and terrain conditions. An engineering geology study of this type provides:

¶ An engineering geology map
¶ A description of the map units
¶ A relative cost evaluation

Fig. 1 represents an engineering geology map for a part of Northwest Honduras, C.A., based on published sources and supplemented by on-the-ground observations. Descriptions of two of the seven units shown on this map are given in Table 1, and the evaluation of relative cost factors are presented in Table 2.

The map shows the distribution of these seven different types of soil and bedrock materials. The map legend designates the excavation characteristics, ranging from soft to hard. Units 1 and 2 represent earth excavation materials, Units 3, 4, and 5

represent part earth and part rock, and Units 6 and 7 represent rock excavation. The engineering geology map thus becomes an excavation map – but there are other important features. As shown in Table 1, covering Units 1 & 6, each map unit gives some significant engineering characteristics. These include terrain, excavation conditions, subgrade conditions, foundation conditions, construction materials, stream crossings, erosion and drainage, and vegetation.

Engineering Evaluation

The type of information given for these two map units has proved extremely useful for projects in the preliminary planning stage. It also can be used in the evaluation of relative costs. The wide range in design and construction costs from project to project and from one region to another presents many complex problems and difficulties, but an approach to realistic cost estimates for engineering works can be simplified considerably.

This is done by assuming numerical values (relative cost factors) for each of six out of the eight categories of an engineering geology map unit (see Table 2). Thus, Unit 1, Alluvium, has fairly level terrain, requiring only a minimum of cut and fill for highway, railroad, and airport construction and permits more or less unrestricted alignments. It consists of loose, unconsolidated material that can be excavated easily by hand tools or power equipment. If considered only on the basis of terrain and excavation conditions, highway construction, for example, would be less expensive per mile than under other terrain and rock conditions.

Unit 6, Limestone, on the other hand, consists of very hard rock, and the terrain is mountainous

TABLE 1 — DESCRIPTIVE LEGENDS

Unit 1 — Alluvium **(Excluding large marsh and swamp areas)**	***Unit 6 — Limestone***
Description – On the north coast, mainly beach sand with some silt, sea shells, and minor gravel. Marshes and swamps occur in the depressions (some of which are shown by a separate symbol) covered by dense jungle vegetation, and underlain by thick deposits of silt, sand, and muck. The inland valleys, river terraces, and a few old lake beds are underlain by interlayered mixtures of sand, silt, and some gravel.	*Description* – Massive, hard, relatively thick-bedded crystalline limestone, with occasional interbedded shale, sandstone, and conglomerate layers. Most beds are steeply dipping; some are severely folded and fractured. Overburden soil is thin, and bedrock exposures abundant.
Terrain – Fairly level land predominates; some gently undulating areas occur near valley walls, and in some river terraces.	*Terrain* – Very hilly to rugged topographic conditions predominate, with massive outcrops of bedrock very common, and many steep ridges and cliffs.
Excavation Conditions – Earth excavation mainly; most of these materials are easily removed by power equipment or hand tools above the water table. Excavations will stand on slopes of 1½:1 or 2:1, but deep excavations may require benches, and vertical sidewalls would require shoring to prevent caving.	*Excavation Conditions* – Rock excavation; blasting is required for the rapid removal of most of the rock; removal by power equipment or hand tools is difficult to impossible. Steep to nearly vertical excavation slopes are fairly stable; tunnels require only limited support except in fracture and shear zones.
Subgrade Conditions – Good to excellent in most portions of the inland valleys that are underlain by sand and gravel; unsatisfactory in marshes and swamps where muck and unstable materials occur with a high water table.	*Subgrade Conditions* – Poor to fair on the thin, stony soils which overlay much of the unit; very poor in deep residual clayey soils in some areas; removal and compaction difficult.
Foundation Conditions – Similar to subgrade conditions; best conditions occur in the inland valleys. Site investigations required.	*Foundation Conditions* – Excellent in the bedrock, but in some of the unit concealed underground cavities and caverns require detailed subsurface investigations.
Construction Materials – Principal streams and rivers, and some terraces provide the best source of aggregates, but exploration is required to determine volume, gradation, and quality; most deposits probably require plant processing for recovery.	*Construction Materials* – Satisfactory for most construction, but careful control is required in crushing and processing for the recovery of aggregates, and in quarrying for riprap and masonry.
Stream Crossings – Many long bridges would be required to cross this unit in an east-west direction.	*Stream Crossings* – Moderate in number; most would require bridges.
Erosion and Drainage – River terraces are easily and rapidly eroded, but because of topographic conditions most of the unit is fairly resistant, and drains rapidly.	*Erosion and Drainage* – Erosion is negligible; drainage and run-off are rapid.
Vegetation – Moderate to sparse in many areas—mainly grass, brush, and some trees; dense, jungle growth in depressions and adjacent to rivers and streams.	*Vegetation* – Moderate to dense cover of brush, vines, and trees. Few areas are clear, except where vegetation is burnt-off. Clearing and grubbing difficult.

TABLE 2 — RELATIVE COST EVALUATION

Category	Criteria	Relative Cost Factor Unit 1 Alluvium	Relative Cost Factor Unit 6 Limestone
A. Excavation Classification	On the basis of (1) for earth, (2-3) for part earth and part rock, and (4) rock excavation	1	4
B. Terrain (Macrorelief)	Based on slope analysis; slopes less than 5° are common in Unit 1, and over 25° in Unit 6	1	5
C. Subgrade Conditions	On a basis of (5) for poor, (2-3) for medium, and (1) for good	2	5
D. Construction Materials	Availability; scarce (5), medium (2-3), and abundant (1)	2	1
E. Stream Crossings	Based on the number per unit of area; high (5), medium (2-3), and low (1)	5	2
F. Vegetation Density	Clearing and grubbing on a basis of dense (5), moderate (2-3), and sparse (1)	2	4
Total Relative Cost Factor		13	21

Note—These categories are not inclusive; some engineering works will require addition to or deletion of some of those shown. Most of the above criteria are obtainable from aerial photos, topographic maps, and published data. Relative cost factors apply to the predominant condition, but do not reflect local variations within each map unit. The rating scale arbitrarily assumes all categories to be equivalent; a specially designed rating scale of relative cost factors can be applied to a specific type of construction. High relative cost factors are intended only as an indication of high construction costs.

to rugged. Highway alignments are very difficult, with steep grades, deep cuts and fills, many bridges and tunnels. Excavation would call for blasting. The other criteria, involving subgrade conditions, construction materials, stream crossings, and vegetation, also must be considered in making relative cost estimates.

Table 2 shows six engineering categories and the criteria needed to assign relative cost factors to them. By adding these factors, a total relative cost factor for each map unit is obtained, which can be compared with the total relative cost factor of any other map unit. This method permits, by inspection, a quick appraisal of relative construction costs for the map units.

Additional Features of the Map

The map can be made still more comprehensive by showing directly (or by transparent overlay) roads, contours, streams and rivers, towns and villages, railroads, airports, canals, gravel pits and rock quarries, and any other topographic features.

When deep subsurface conditions are important, as for tunnel and other underground construction, cross sections showing the geologic structure can be prepared, provided that sufficient geologic data are available.

Limitations of the Map

Where large land areas are involved, where soil and bedrock conditions are complex, where published data are inadequate, unreliable, or nonexistent, the use of photogeology and other techniques may be necessary to prepare an engineering geology study. An on-the-ground reconnaissance by the soils engineer and the engineering geologist also would be required.

Moreover, a study such as presented here for Northwest Honduras is by no means intended to supplant a detailed field investigation and laboratory testing. These still are required to obtain information for final design at specific sites.

Summary

The engineering geology map and study make it possible for the engineer to gauge quickly, by inspection, the relative difficulties of design and construction and the relative costs in the various map units of his project area. They also permit a quick appraisal of relative difficulties that would be encountered on various types of engineering work within a single map unit.

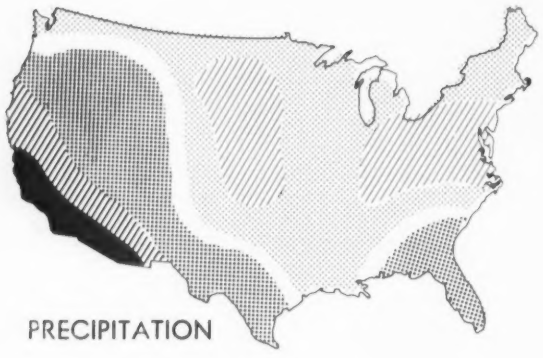
For preliminary and general planning purposes, this approach provides a basis for selection of those units that are economically feasible for the requirements of a specific project.

This engineering geology study is, then, a guide to excavation, engineering characteristics, and relative cost estimates. It also has proved useful as a guide for locating construction materials and for selecting sites for underground installations, airports, highways, and military construction. ▲▲

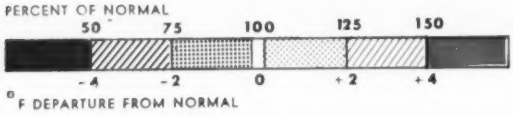
KRICK WEATHER OUTLOOK

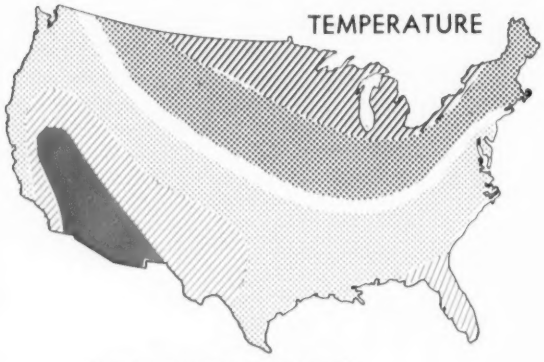
JUNE 1959

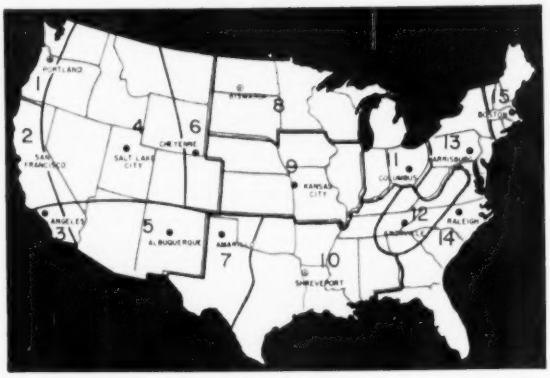
Prepared Exclusively for CONSULTING ENGINEER



PRECIPITATION







CONSTRUCTION DAY FORECAST LOCATIONS

CONSTRUCTION DAY CRITERIA

To be considered a construction day on these charts, the day's maximum temperature must be more than 38 degrees. There must be less than six inches of snow on the ground. There must be less than six hours of active precipitation during the period between the hours of 7 a.m. and 5 p.m. There also cannot have been more than one inch of rainfall on the preceding day.

JUNE HIGHLIGHTS

During June, near seasonal construction weather is expected over much of the United States. Although the northern portions are likely to be slightly cooler than normal, unusually cold temperatures are not anticipated. These cooler than normal readings should be the result of frequent cloudiness and intermittent scattered shower activity, which should tend to lower the daytime high temperature readings. Warmer than normal average temperatures are expected over the western and southern regions of the country. Predominantly drier than normal conditions are anticipated to continue in the southwestern quarter of the country as the summertime stormy patterns are steered well to the north. Southern desert regions and most of California are expected to continue dry during the month. Important stormy patterns are expected to develop off the Pacific Northwest coast in June and move inland along the northern borders of the nation through the Rockies, spreading over the Midwest and continuing eastward to the Atlantic Coast. Surges of tropical air moving inland from the Gulf of Mexico should trigger frequent shower activity in the Midwest, causing much above normal moisture throughout the central and lower Great Plains. As the stormy patterns move toward the Atlantic, a concentration of above normal moisture is expected from the Mississippi River Basin eastward. As a whole, construction weather looks favorable over the nation during June. The number of favorable construction days will be below normal only in the areas receiving much above normal moisture.

TEAR OUT ALONG PERFORATION.

These forecasts are prepared by Irving P. Krick Associates, Inc., the world's oldest and largest weather engineering firm. The forecasts are based on methods developed by this group at California Institute of Technology prior to World War II. After the War, the methods were adapted to high speed electronic computing machines to shorten the time required to solve the complex problems of the atmosphere. Ultra-long range forecasts, up to a year or more in advance, are now available. Information on other Krick weather services is available by writing to the home office of the firm at 460 South Broadway, Denver, Colorado.

CONSTRUCTION DAYS

JUNE 1959 ESTIMATES															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
LOWEST	25	28	29	27	29	26	28	24	24	27	27	27	24	26	23
AVERAGE	28	29	30	29	30	28	29	27	27	29	28	28	27	28	26
ESTIMATE	28	29	30	29	30	28	29	27	25	29	28	28	26	28	24

These estimated construction days for key cities in the United States should be interpreted as an average of estimated conditions over the forecast area. To obtain the best results, the forecast number of construction days should be compared with the temperature and precipitation anomaly maps and the timing estimates to determine the probable number of construction days in your locality. The forecast construction days are based on average construction day requirements as defined under "Construction Day Criteria," and should be adjusted for individual operations.

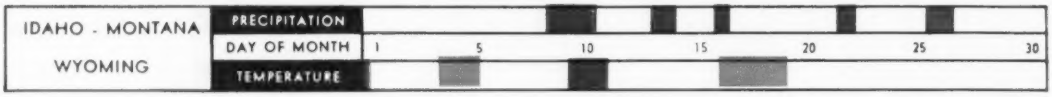
JULY AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	31	31	31	31	31	31	31	31	31	31	31	30	31	31	30
LOWEST	30	29	31	30	29	27	29	28	23	28	26	26	21	24	26
AVERAGE	30	31	31	30	31	29	30	30	28	30	29	28	28	28	29

AUGUST AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	31	31	31	31	31	31	31	31	31	31	30	31	30	31	31
LOWEST	27	29	29	28	30	27	27	26	26	26	26	27	26	27	20
AVERAGE	30	31	31	30	31	30	30	29	28	30	29	30	29	28	27

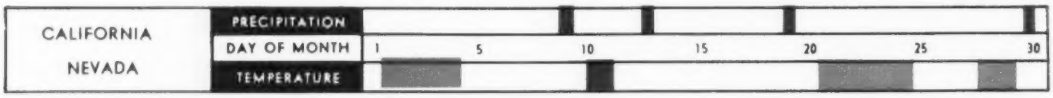
*Historical Average, Not a Forecast

JUNE 1959 TIMING OF SIG

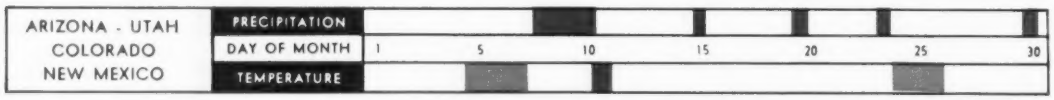
Look for weather conditions to range near normal in the Pacific Northwest during June. Theatening, showery weather is expected in coastal areas during the first few days of the month. Showers indicated around the 6th are likely to effect mainly Canadian border areas.



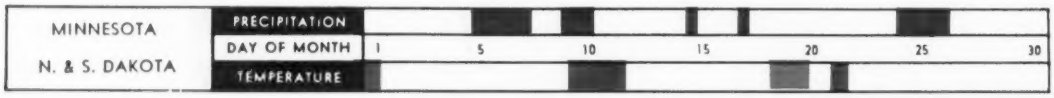
The showery periods indicated during the last 15 days of the month are expected to be more regular in occurrence over the northern Rockies. Near to slightly below normal average temperatures are anticipated, with the northeastern sectors likely to have the lowest readings.



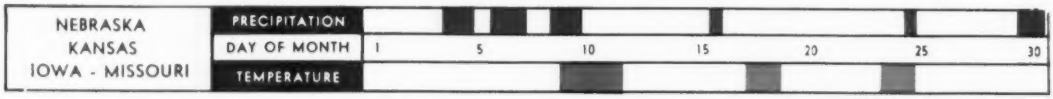
A much drier than normal month is on tap for California and Nevada. The indicated showery periods can be expected to concentrate principally in the Sierras and Nevada, and even over these areas the result primarily will be threatening cloudy skies and widely scattered showers.



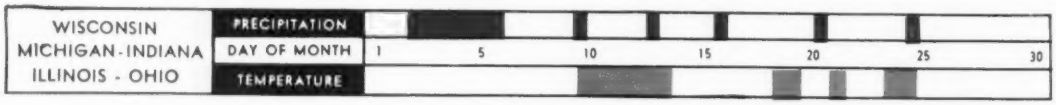
Southern regions of this four state area are expected to have much below normal precipitation, with many desert sectors likely to receive no measurable rainfall. The periodic showers indicated during the last 15 days of the month can be expected to concentrate mainly over Utah.



Slightly cooler than normal average temperatures are anticipated for this area. Minnesota and eastern sectors of the Dakotas should be predominantly cool just prior to midmonth. The heaviest rainfall, as compared to normal, is likely to occur in southern portions of the region.



Look for cloudy and intermittent showery weather in this region during the stormy intervals indicated between the 3rd and the 10th of the month. The showers shown on the timing bar for a day or two around the 25th should concentrate mainly over the northern half of the area.

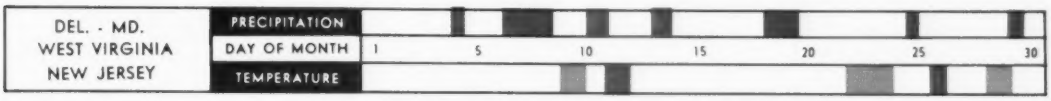


In general, near to slightly above normal rainfall with slightly cooler than normal average temperatures are in prospect for the Great Lakes region during June. A prolonged interval of stormy weather is expected between the 2nd and the 6th of the month.

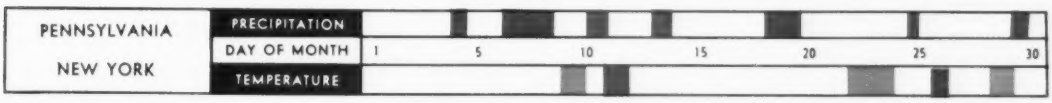
IGNIFICANT WEATHER EVENTS

RAIN
SNOW
WARM
COLD

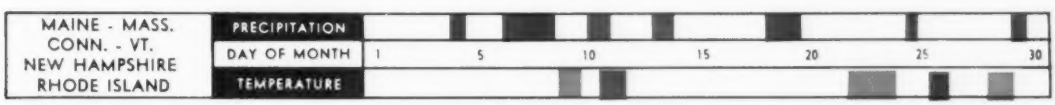
The timing bars below are intended to indicate periods of important general storminess and important departure from temperature normals in areas indicated. They are highly accurate over the area indicated, but are too general to pinpoint small local storminess or showers. Allow one day on either side of indicated storm or extreme temperature periods for general planning. Combination rain or snow shading indicates either one or both.



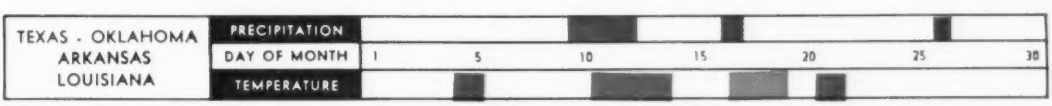
This region can anticipate slightly cooler and wetter than normal weather during June, with the southern portions receiving the heavier amounts of precipitation as compared to normal. The intervals of the 6th through the 9th and 18th through the 20th should bring important rainfall.



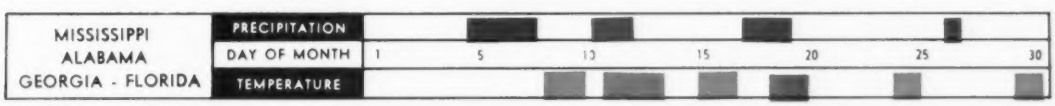
Look for cooler and wetter than normal weather over Pennsylvania and New York. The heavier rainfall totals as compared to normal are likely to occur in southern sectors. No major hot spells are anticipated, but relatively warm weather is expected during the indicated warm periods.



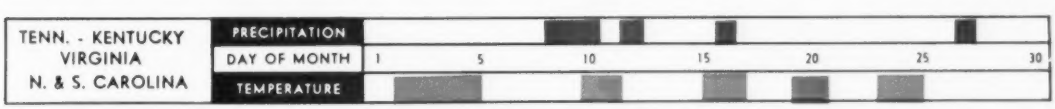
Cooler than normal temperatures are in prospect for the New England states during June. Intervals of the 6th through the 9th and the 18th through the 20th should bring important rainfall; in the other stormy periods the precipitation will be mostly intermittent showers.



No unusually hot weather is anticipated. However, the last half of the month could be quite mild in southwestern sectors. Important moisture is expected over the area between the 9th and the 12th, with the stormy periods thereafter bringing mostly intermittent showery weather.



Near normal rainfall accompanied by slightly warmer than normal average temperatures is the weather outlook over the lower South. Look for quite general storminess between the 4th and the 8th, and around the 18th, with northern sectors receiving the heavier amounts.

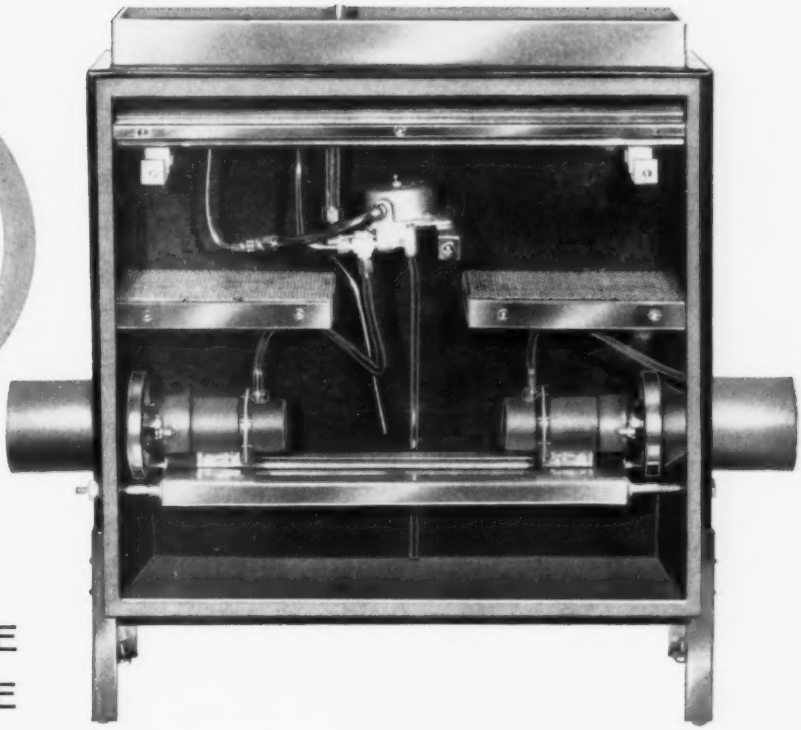


June should be a much wetter than normal month in this area. The storminess expected following midmonth should concentrate mainly in the southern half of the region. Quite stormy conditions could prevail east of the Appalachians during the period just prior to the 10th.

NEW

CON-VOL EQUIPPED HIGH VELOCITY UNITS

CONSTANT VOLUME UNDER ALL CONDITIONS



EXCLUSIVE FEATURE ASSURES PRECISION CONTROL OF AIR VOLUME AND TEMPERATURE

The new Thermotank Con-Vol Unit delivers constant air volume over a wide range of varying inlet pressures. Instant response and positive valve closure are obtained due to the complete absence of linkage or complicated operating mechanism. Both the hot and the cold valves are regulated by the flow controller as conditions demand. An access door permits inspection of all moving parts and easy removal of valves and controls. For more information on Con-Vol equipped units ask your Thermotank-Agitair representative or write direct to Air Devices Inc.

THERMOTANK AGITAIR

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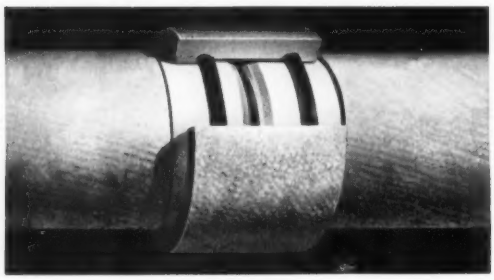
its bore stays clean year after year



The finest coupling in the industry! Exclusive patented "K&M" FLUID-TITE Coupling connects in two easy steps. Seals tight and stays tight . . . no matter how high the pressure climbs. Sealing rings are self-energizing. No cumbersome coupling puller is required. And, a 5° deflection per coupling if you need it.

"K&M" Asbestos-Cement Pressure Pipe is as *modern* as the Jet Age in which we live. This tax-saver sends maintenance costs tumbling.

The bore remains smooth and clean . . . no clogging and no rusty discoloration of water . . . and pumping costs remain low. Being made of tough, high-tensile-strength asbestos fibers and portland cement, "K&M" Asbestos-Cement Pressure Pipe is practically indestructible. Won't corrode or tuberculate. And, it's completely immune to electrolysis. Joints are permanently, automatically root-tight and water-tight.

for uninterrupted, trouble-free service

"K&M" Asbestos-Cement Pressure Pipe is a thrifty pipe. Its low initial cost is often your last cost. Its lightweight reduces shipping and handling costs.

This thrift carries over into installation. You can install "K&M" Asbestos-Cement Pressure Pipe in practically all kinds of weather and soil conditions . . . with unskilled labor . . . and without heavy machinery. In fact, you can lay more pipe per hour than you've ever done before.

What makes "K&M" Asbestos-Cement Pressure Pipe so special? Eighty-five years of asbestos engineering by one of America's pioneers in asbestos products. Put this wealth of experience to work for you. Write to us today.

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
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A NEW WRINKLE IN NETWORK DESIGN

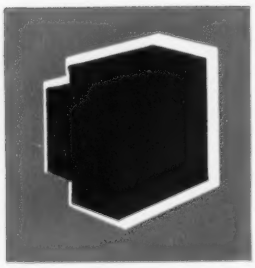
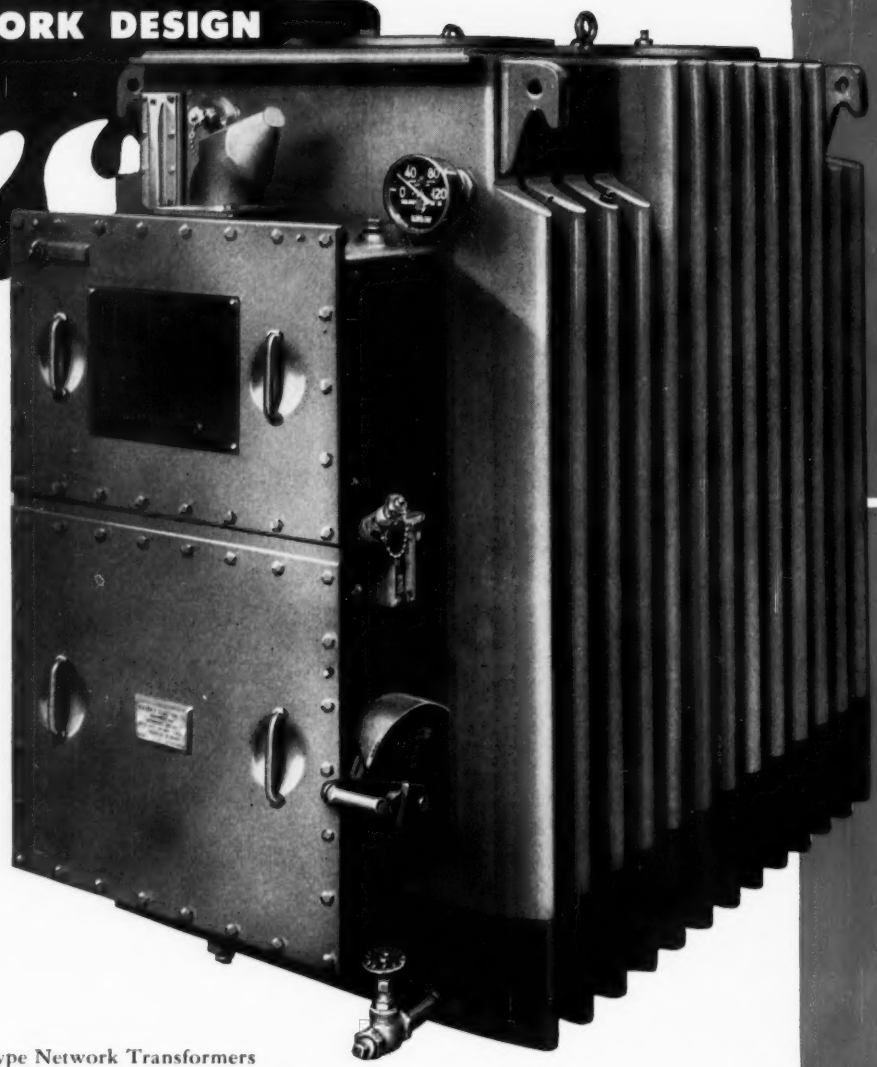


Diagram illustrates savings in space of new design as compared with older type network transformer.



Moloney Subway or Vault-Type Network Transformers with corrugated tanks are strong, rugged units developed by Moloney to answer some of the problems associated with the use of network transformers.

These units are built to conform to the EEI-NEMA Standards for Network Transformers or to conform to customers specifications.

Moloney Network Transformers offer your system the performance, dependability and trouble-free service expected of all Moloney products . . .
Specify Moloney Transformers for Quality . . . All Along The Line.

MEDB-13

MOLONEY ELECTRIC COMPANY

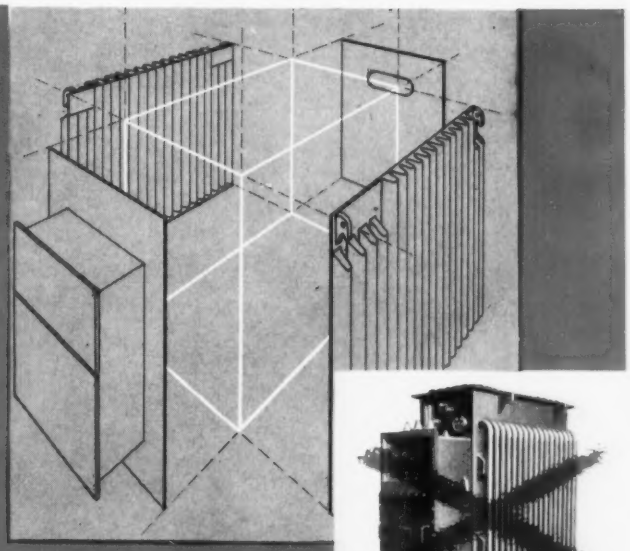
Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

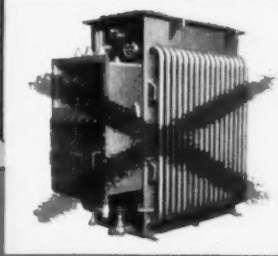
SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

REAL TANK CORRUGATIONS

Moloney Nerwork Transformer tank walls are really corrugated (as shown in diagram) and are welded only at the corners.

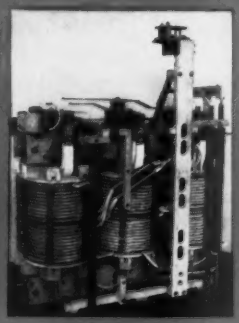
The old problems of corrosion spots and servicing accessibility are gone; now inspection, cleaning and painting is easily done from above.





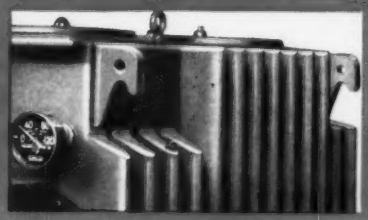
RUGGED CORE-AND-COIL UNIT

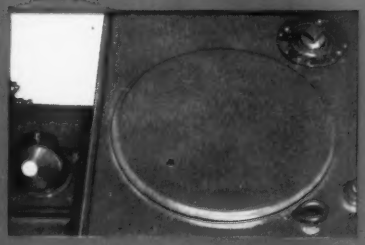
The core-and-coil assembly is a rugged, compact unit solidly blocked and framed. Every lead is adequately insulated and rigidly braced. All bus bars are supported by stand-off insulators. The core-and-coil unit is securely fastened into its position in the tank by adjustable clamps.



INCREASED MECHANICAL STRENGTH

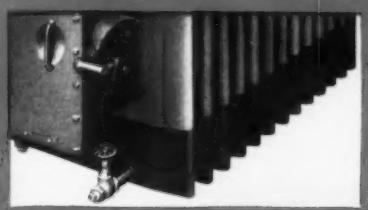
Moloney's ability to corrugate the steel plates of the transformer tank wall produces a tank of inherently greater mechanical strength, thereby eliminating the need for cross bracing.





SEALED AGAINST MOISTURE

Tank covers and handholes are welded on, absolutely sealing the tank against the entrance of moisture.



UNDERCOATING OF TANK BASE AND LOWER TANK WALLS

Maximum protection against rust and corrosion is obtained by the application of protective undercoating extending up the tank walls to a point above the nomal level of submersion.

Atoms in Action

JOHN F. LEE
Broughton Professor and Head
Department of Mechanical Engineering
North Carolina State College

Russia's Nuclear Power Program

RUSSIA has watched our nuclear power program with intense interest, and we would be wise to observe Russia's program with equal care.

The present Soviet nuclear power program began in 1955. This program has been regarded as primarily a research and developmental endeavor, and it has advanced methodically. The first nuclear power plants are located in the industrial areas of European Russia where power consumption is rising rapidly and generating costs are high, as is evident from a comparison of generating costs in various regions of the Soviet Union based on the assumption that one ruble is equal to 25 cents.

Region	*Fuel*	*Generating Cost cents/kwh*
Moscow	Coal	2 to 2.5
Moscow	Peat	2.5 to 3
Urals (industrial)	Lignite	2
Siberia	Coal	1 to 2

The Moscow industrial area accounts for nearly one fifth of total Soviet industrial production but lacks a sound fuel and power base. Although much of Moscow's electrical energy will come from the Volga hydroelectric development via high tension lines, its future increase in power requirements will have to be met by nuclear power stations. The same situation applies to Leningrad, which runs 90 percent of its industry on imported fuel. The present plan, providing for a total of five nuclear power stations, will include two with capacities between 400 and 500 Mw near Leningrad, two near Sverdlovsk in the Urals, and one near Voronezh.

The Soviet program covers three major power-reactor systems, and their relative merits will provide a basis upon which the next Five Year Plan (1961-1965) will be drafted.

¶ A pressurized water reactor of 200-Mw gross capacity, operating on natural and enriched uranium oxide clad in zirconium. Prof. I. V. Kurchatov was responsible for the design.

¶ A graphite-moderated, water-cooled reactor using slightly enriched uranium fuel elements, with a gross generating capacity of 100 to 200 Mw. This unit, designed under the supervision of Prof. D. Blokhinstev, is based on the 5000-kw pilot plant of the Academy of Sciences of the USSR.

¶ A heavy water-moderated, carbon dioxide-cooled, 200-Mw reactor, using enriched uranium for fuel.

Considerations of efficiency parameters have led Soviet designers to propose the following variants of the first two types or reactors:

Project	*I*	*II*
Electrical output (gross), Mw	420	400
Electrical output (net), Mw	390	375
Operating time per year, hours	7500	7500
Fuel charge per reactor, tons	40	185
Enrichment average, percent	1 to 2	1.2
Burn-up equivalent, Mw/day/ton	3500	3500
Pressure of coolant at outlet, atm	100	100
Temperature of coolant at outlet, °C	275	300*
Steam pressure in secondary loop, before turbine, atm	30	90
Steam temperature in secondary loop, before turbine, °C	330	500**

*Steam **Superheated

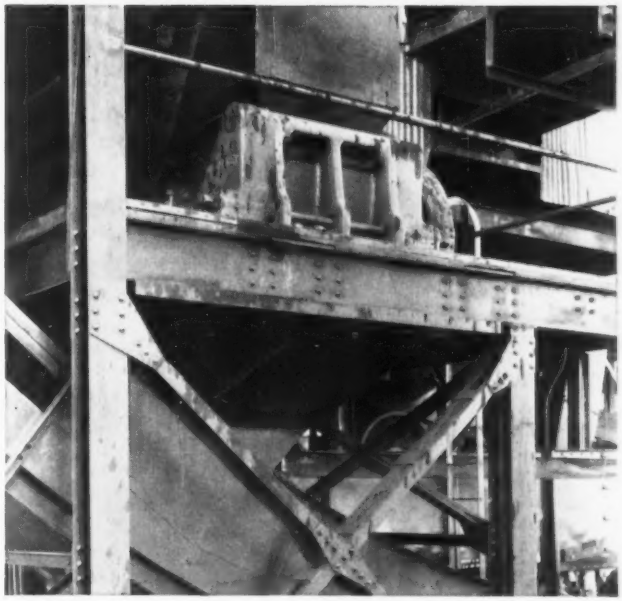
Project I reactor is cooled and moderated by ordinary water. It has two loops—a primary loop located in the reactor where water is heated, and a secondary loop in which the heated water is used to generate steam. This reactor will operate three 70,000-kw turbines. It is estimated that it will have a conversion factor of fuel of about 0.8, based on

"Profit-squeeze puts new emphasis on efficiency"

Efficient, dependable Jeffrey equipment is a valuable antidote for rising costs in coal preparation and utilization. It does important jobs better, faster... contributes to lower operating costs and lower maintenance costs.

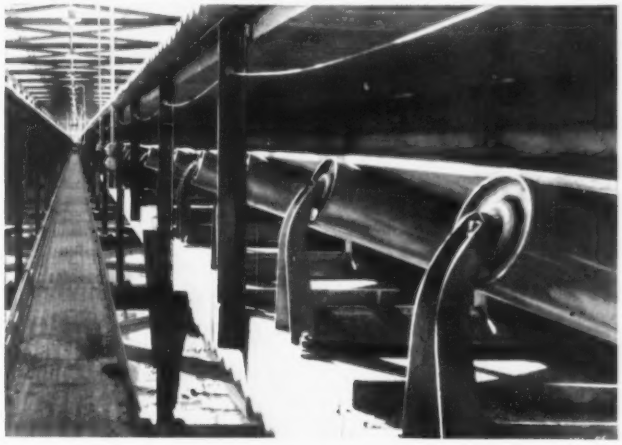
Engineering firms assigned the responsibility for planning and constructing new industrial facilities select Jeffrey equipment as a means of easing the profit-squeeze. It pays to team up with a top-flight engineering company; they are familiar with Jeffrey products and their use.

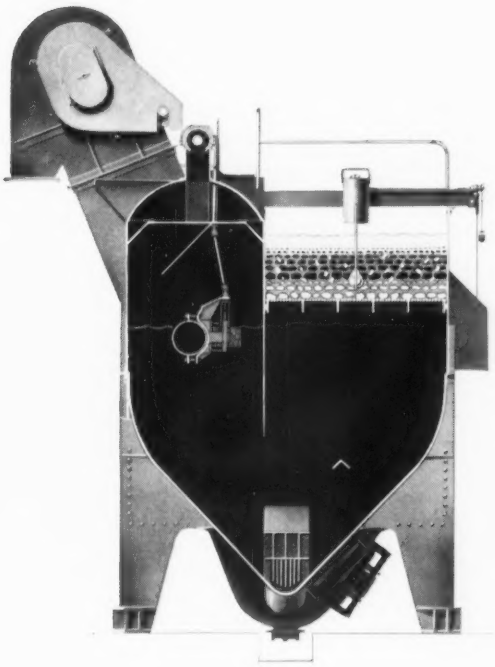
For specific information regarding any of these products, get in touch with The Jeffrey Manufacturing Company, 822 North Fourth Street, Columbus 16, Ohio.



Crushers: *Jeffrey offers a type and size for every sizing requirement. This is a 30" x 60" single roll crusher of the type specified for coal preparation plants.*

Permaseal Idlers: *Give extra-long service on the toughest jobs with a minimum of maintenance. Double-diaphragm seals make certain grease can't get out to foul conveyor belts; dirt can't get in to damage bearings.*





Baum Jigs: *Provide a low-cost means of cleaning coal, separating fine and coarse sizes simultaneously, and recovering above 99.5% of the coal of a specified quality. Jeffrey air-operated jigs give exceptionally high capacity per unit of area, often ten times that of conventional plunger type jigs.*

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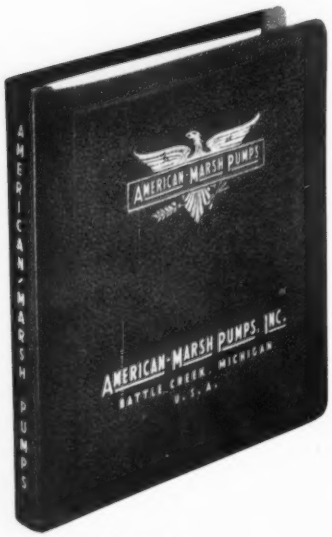

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thermal neutrons. At present, great hopes seem to be attached to pressurized water reactors working with natural and enriched uranium. Among their advantages are compactness, simplicity of design, and good utilization of fuel. The processing of spent fuel will yield plutonium in sufficient quantity to enrich the next charge. Uranium-235 will be needed only for the first charge.

The Project H reactor is graphite-moderated and water-cooled, and its prototype is the USSR Academy of Sciences experimental reactor. The reactor heat is used to generate superheated steam in the secondary loop. This type of reactor has received widespread publicity, but the Russians admit the operating costs are high and the thermal efficiency only 17 percent.

The fate of the third type, the heavy water-moderated gas-cooled reactor, has for some time been obscure. However, an article by an engineer name Yermakov, the head of the Soviet nuclear construction program, in the Soviet Ministerial publication "Electric Power Stations," stated that a nuclear power station with a heterogeneous reactor moderated by heavy water was also under construction (probably the plant near Voronezh).

Initially, the cost of heavy water was an unfavorable factor with this kind of reactor, but since heavy water requirements have been reduced, this system may well prove to have economic advantages. The system gives Soviet constructors experience with gas-cooled reactors, and with the temperature of the carbon dioxide already said to be 500 C at the reactor outlet, it is likely further improvements can be realized. Moreover, the USSR is building new heavy water plants, and Czechoslovakia is planning one by 1960.

Experimental Pilot Plants

The preceding types of reactors are intended to provide data for the study of the cost of the fuel factor in the total generating costs of nuclear power stations. In addition, four smaller experimental pilot plants of between 50,000 and 70,000 kw are planned. These will be grouped in an experimental center, which is being organized by the Ministry of Power Stations and the Power Institute of the USSR Academy of Sciences. The first of these small plants will generate steam directly in the reactor. After superheating, the steam, at a pressure of 30 atmospheres, will drive a 70,000-kw turbine. This plant will be used to study water content of steam and the use of radioactive steam.

The second of the small pilot plants is graphite moderated and sodium cooled. The use of sodium coolant will raise the steam pressure and temperature without raising pressure in the reactor itself. The steam pressure in this type will be 100 atmos-

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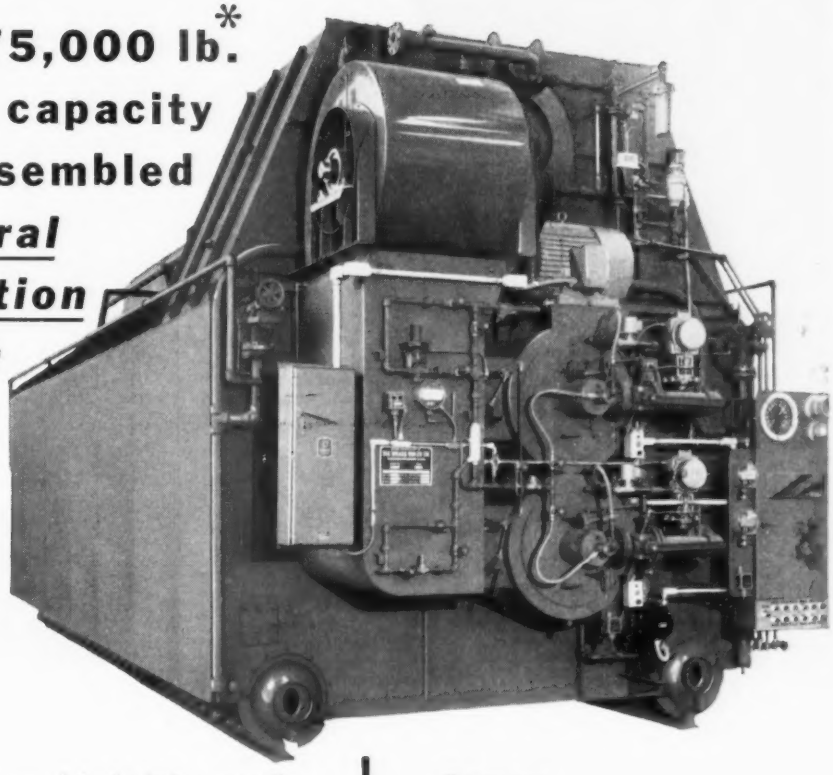
a new 75,000 lb.* per hour capacity shop-assembled *natural circulation* boiler



*75,000 lbs. per hour present capacity.

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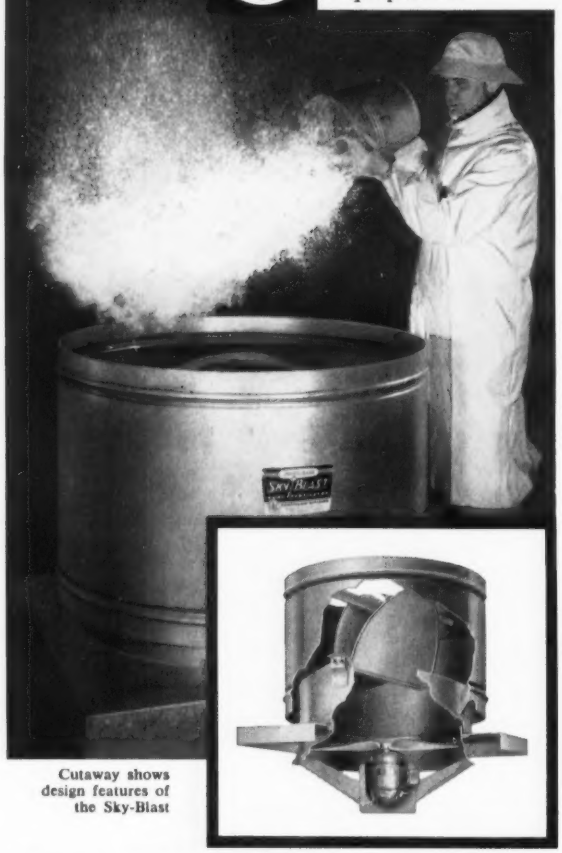

Cutaway shows design features of the Sky-Blast

Free-Flow SKY-BLAST® Roof Ventilators are WEATHERPROOF!

Even if the rain comes down in buckets, there's no need for weather covers on SKY-BLAST roof ventilators. In operation, the powerful airstream keeps out snow, rain and sleet. At rest, butterfly dampers form a water-tight seal, won't leak a drop. With no interfering covers, more air is moved at less cost. Fumes are thrown high in the air to prevent re-entry into the building and to eliminate roof maintenance problems created by other types of ventilators. Wind velocity or direction can't affect performance. Heavy gage steel surfaces are hot-dip galvanized for real sou'wester protection. With patented, non-clogging rainshed, low wind guard, rugged base and condensate drain, it's always fair weather beneath a SKY-BLAST. Wind tunnel proven ratings to 78,000 cfm. Send for bulletin 680—CE

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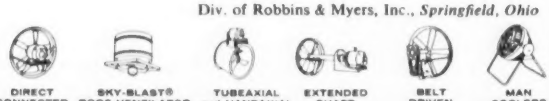

MOVING AIR IS OUR BUSINESS®

pheres and the temperature about 500 C. It has a triple loop with an alloy of sodium and potassium in the intermediate loop to prevent contact between radioactive sodium in the first loop and steam in the third loop. Thermal rating of this plant is between 150,000 and 180,000 kw, and the electric power rating is 50,000 kw. This reactor will provide data for the study of neutron characteristics of the graphite reactor with sodium coolant.

One plant will have a breeder reactor (U-238 — Pu-239) with an electrical output of 50,000 kw. The primary loop will use sodium, heated in the reactor from 290 to 485 C, with the sodium transferring heat to an alloy of sodium and potassium heated to 450 C. Steam is obtained at 30 atmospheres and 400 C. This reactor is to be used for the study of operating costs.

The last type in this Russian pilot plant program is a heavy water homogeneous reactor with fuel in the form of uranium salts in solution or in suspension in heavy water. Its thermal rating will be 25,000 to 35,000 kw.

Soviet engineers attach particularly high hopes to the use of superheated steam (Project II). The uranium-graphite combination of thermal neutrons and water coolant is considered a suitable design for high capacity power stations operating on superheated steam. Higher steam temperatures and pressures result in an efficiency of 35 to 38 percent as compared with 15 to 17 percent for the existing power station. The decision to use superheated steam had been made after it was established that the steam superheated in the reactor has a permissible activity tolerance. Provided the salt content of the superheated steam does not exceed 0.05 mg/kg, the radioactivity at the surface of the steam loop of the reactor and the turbine due to precipitating radioactive substances is far below the permissible level. Furthermore, the concentration of radioactive aerosols in the turbine room does not exceed the normal dose even with maximum assumed leakage of water and steam.

Nuclear power capacity to be installed in the USSR before 1961 is planned to be between 2000 and 2500 Mw. This will be in large capacity stations of 400, 600, or even 800 Mw, for Russia has decided to proceed immediately with the large-scale power station program without waiting for the development of more efficient enriched-fuel systems. With the Soviet demand for electrical power growing at an enormous rate it is not important if the present stations are technically outdated in 20 years, as long as they still can be run economically. With the improvement of steam parameters and slightly enriched fuel systems they may be equally as attractive as the more complicated designs. ▲▲

Coordinating "umpteen" different suppliers is costly

Dealing with a multitude of suppliers means endless conference hours coordinating equipment designs, delivery schedules, erection services. It means many phone calls, telegrams, voluminous correspondence.

Here's an easy, efficient way to get most of the equipment for your project — pumps, motors, control, condensers, blowers, generators, etc. One call and your A-C representative goes to work with an Allis-Chalmers Industry Application section.

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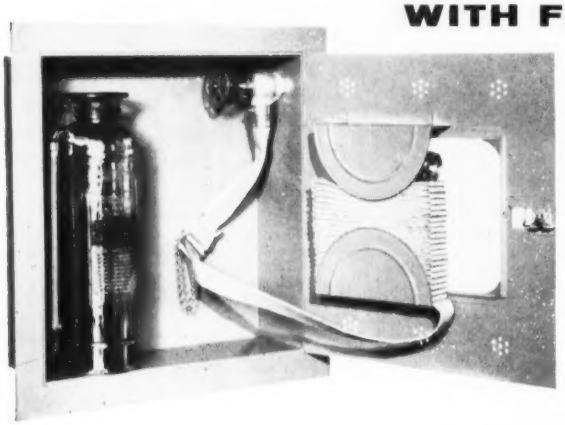
booklet gives basic fire protection requirements!

NEW! ALLENCO HOZEGARD

WITH FOUL-PROOF DOOR RACK!



Rack swings full 180°, never fouls hose line. Now, when seconds count, there's no delay in fire-fighting . . . user just grabs the hose and runs! The hose is racked on the cabinet door that swings out 180°. The foul-proof half-circle racks mean the hose can't snag when it's needed most. The new Allenco Hozegard cabinet, when specified with exclusive Hose Clip, is the first fire hose cabinet to be completely Underwriters' listed! Each Hozegard installation saves 25% to 30% by eliminating the expensive pin-type rack and the time to install the hose on it. Choose Allenco Hozegard cabinets with or without extinguishers and with Fire Department valve when desired. There are sizes and styles to fill most requirements. All have steel cabinet with frame welded to body and hold up to 100 feet of 1½" linen hose.

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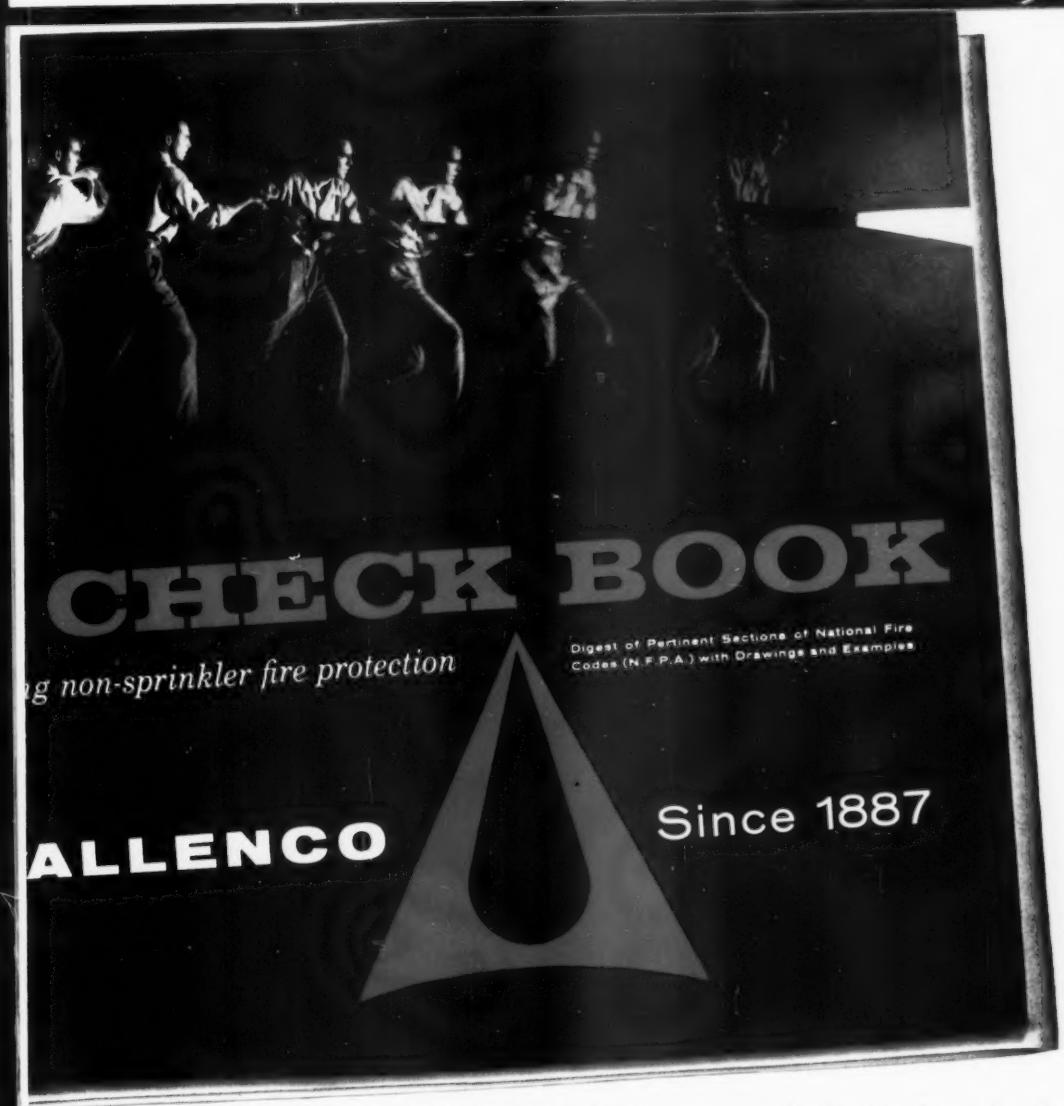
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g non-sprinkler fire protection
Digest of Pertinent Sections of National Fire Codes (N.F.P.A.) with Drawings and Examples
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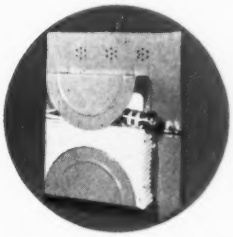
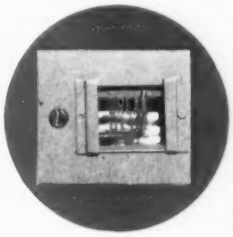


Free swinging door rack means foul-proof withdrawal and ready aiming at fire.

Exclusive hose clip makes cabinet semi-automatic—perfect for one-man operation.



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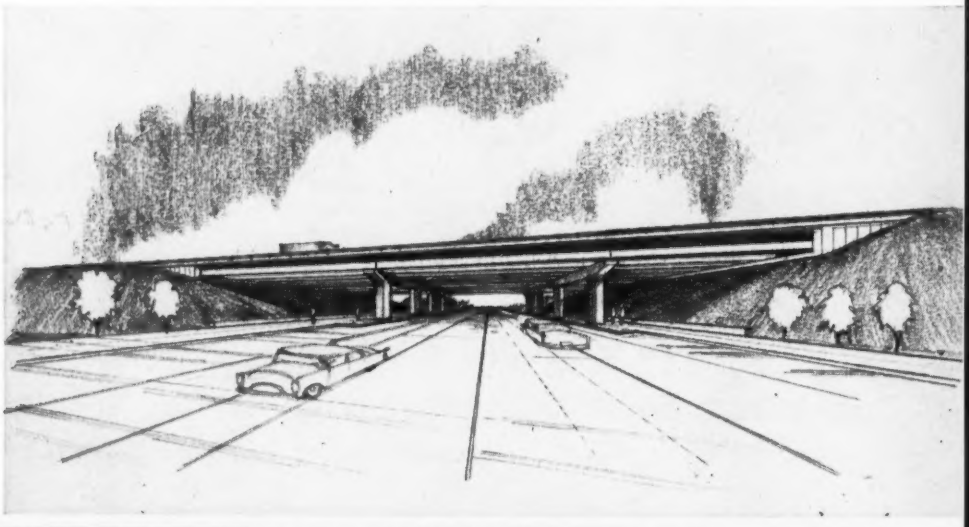
CITY ZONE STATE

Mr. C. H. Darby, Mr. O. J. Porter and Mr. W. F. Leivonen, Jr. discuss a problem involving the Burr Oak Avenue bridge on the Illinois Toll Highway.

Typical composite welded girder twin bridges carrying 8 lanes of Interstate Highway traffic over wide street in Salt Lake City.



Bronson Road overpass on Connecticut Turnpike. Steel can be welded, flame-cut, riveted, bolted. It's versatile and available.

Winning a coveted War Department award. Presented to Mr. O. J. Porter for discovery of a new method of compaction and stabilization of subgrades enabling airfield runways to be built to support very heavy airplanes.

50 steel bridges now being designed for Salt Lake City Interstate Highway

by Porter, Urquhart, McCreary & O'Brien, Consulting Engineers.

Steel bridges for some of the important highways in the country have been designed by the firm of Porter, Urquhart, McCreary & O'Brien. These include bridges on the New Jersey, Ohio, Connecticut, New Jersey Garden State and Illinois Toll Roads. Their big job at present covers seven miles of the Utah Interstate Highway which cuts through Salt Lake City and includes 50 steel bridges of composite welded girder construction. The highway will provide six and eight lanes of traffic, but allows space for eight and twelve lanes, eventually.

Steel goes up in hours!

According to Mr. O. J. Porter, Managing Partner, a large proportion of the firm's present work is in highway construction, including viaducts and overpasses. Both minimum cost and speed in opening the way to traffic are important considerations. Due to the ease of transporting fabricated short steel spans to urban bridge sites, erection is accomplished in a matter of hours, minimizing detours and tie-ups in traffic. Traffic hazards are substantially reduced by eliminating falsework. Furthermore, headroom may be increased in tight places through steel's high tensional strength qualities.

Steel adds beauty. By using steel, designs may be executed which actually add to the beauty and dignity of an urban neighborhood. This is an important consideration which should always be kept in mind.

Steel reduces costs. Frequently, the lighter construction possible with steel, reduced foundation costs and faster erection saves labor. New, tougher, high-strength and alloy steels provide greater strength with less bulk.

Increased facilities. There is an ever-expanding demand for steel because of its many advantages in the fast-growing market for bridge construction. The steel industry has had the foresight to grow with this vigorous market through greatly expanded facilities for manufacture of structural shapes and plates. You can confidently design in steel—the material you know best, the material that offers most—knowing it will be available.

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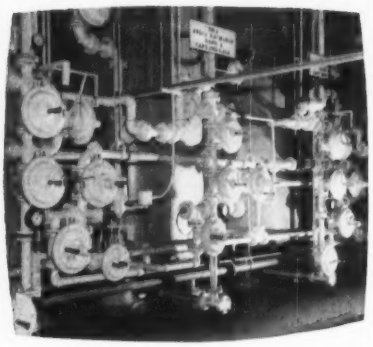
MODERN EQUIPMENT FOR ionXchange



Illinois Water Treatment Co. was incorporated over 20 years ago to use the newly-discovered resins in the development of ionXchangers.

1942 By this time, IWT had already built more than 50 successful multi-bed ionXchangers (some of which are still in use today).

1943 IWT brought "automation" to ionXchange with the introduction of automatic ionXchangers, some of which were very large. (Some of *these* are still operating today, also.)

1947 This was also the year when IWT brought out the first large (400 gpm) ionXchanger for silica removal.

1949 IWT built the first commercial *Mixed Bed* ionXchanger.
(U.S. Patents 2605084 2771424)

1954 A huge 5,000 gpm fully-automatic mixed-bed ionXchanger was designed and built by IWT to remove silica from make-up water for high-pressure boilers. This plant has now de-ionized over SIX BILLION pounds of water.

1957 IWT introduced "Counterflow," the first really new idea in multi-bed ionXchangers since the introduction of silica-removal techniques. (Patent pending.)

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These ideas, and other IWT developments, can mean reduced costs, improved operations, and greater efficiency in your plant. *Check with your IWT representative.*

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Field Notes

MARJORIE ODEN
Eastern Editor

CONSULTING ENGINEERS should view a new report, "*Expanding Private Investment for Free World Economic Growth*," with mixed emotions. But above all, they should lose no time in studying a copy.

Important to Consultants

Prepared at specific request of the Department of State, this report could lead to the consulting engineer getting tax deferment on foreign projects, being retained by the government to do feasibility studies, and at long last getting help from American embassies in learning about forthcoming projects before it is too late.

This report also could mean that it would become a matter of policy *not* to have consulting engineers as prime contractors on foreign projects – both public and privately financed. And it stresses the advantages of the "package deal."

Right now, this brochure is being studied closely by the Departments of State and Commerce with the idea, according to C. Douglas Dillon, Under Secretary of State for Economic Affairs, and Henry C. Kearns, Assistant Secretary of Commerce, of determining which of the recommendations should be adopted. Since little legislation (except for a number of income tax revisions) would be involved, the only way for the consultant to follow the progress of the ideas is to lose no time in presenting his case to the proper persons.

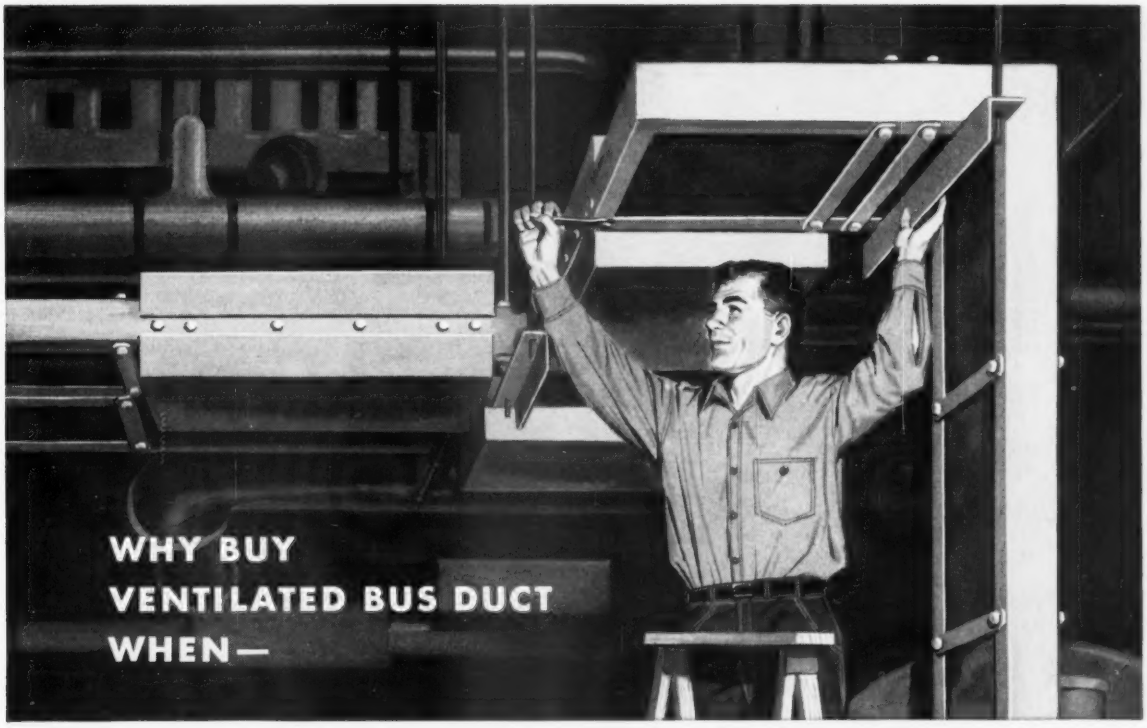
Another strong advocate of the report is Congressman D. Hale Boggs (D-La.), who told the *Washington Post and Times Herald* he hoped the report would "not suffer the fate of other Administration studies and reports of the past." Boggs has sponsored a bill providing some of the basis legislation necessary for the implementation of the report – a bill to give tax advantages to Foreign Business Corporations.

Favors Private Enterprise

One of the most uncomprising advocates of private enterprise to come out of Bureaucratic Washington in some time, the brochure begins by pointing out that ". . . most of our great economic assets as a nation – capital, know-how, and resourcefulness – are in private hands and have not been brought adequately to bear on the problems of the newly developed countries."

And, "Our approach reflects a policy and administrative preference for those measures which will release and stimulate as much private activity as possible with a minimum of government interference in the free play of private decisions. We feel that business will do more, and do a better job, to the extent that it does not have to seek government approval or negotiate for government assistance before going ahead on its own."

It also points out (with a note of caution to select personnel for foreign work carefully) that "One of the chief virtues of this aspect of private investment is the natural,



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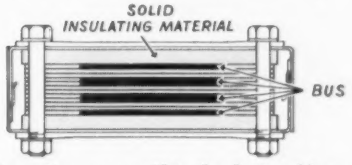
mounts in any position without de-rating

—*and costs no more*

*(low impedance)

Square D totally enclosed low-impedance bus duct mounts in any position without de-rating, because it doesn't need ventilation. Moreover, you can have all the advantages of totally enclosed duct without the price penalty of a "special," because all Square D low-impedance bus duct is totally enclosed. Square D feed-in duct has no ventilation holes, is protected from physical damage and dust accumulation. It's smaller than ventilated duct by as much as 50%. Doesn't it make sense, when buying low-impedance duct, to specify a product that meets every one of your requirements? Square D totally enclosed low-impedance duct costs no more —why settle for less?

Here's Why Square D's EXCLUSIVE Design makes ventilation unnecessary



The entire space within the duct and between the bus bars is filled with a solid insulating material which conducts the heat to the surface. There are no dead air spaces inside the duct. Square D totally enclosed low-impedance duct is listed with Underwriters' Laboratories and meets U/L requirements for temperature rise in any mounting position.

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informal, and day-to-day manner in which it achieves secondary benefits in the normal course of business. Each U. S. enterprise abroad is inevitably a source of technical assistance and a training center for personnel, contributing significantly to the total quantity of skills available in the country."

Advocates Tax Advantages

Taxation rears its ugly head, as a deterrent to investment and initiative, and the report advocates a number of remedies.

First, the formation of Foreign Business Corporations is suggested. "A domestic corporation could elect to qualify as an FBC if at least 90 percent of its income is derived from sources outside the United States and at least 90 percent of its income is from the active conduct of trade or business abroad, either directly or through equity participation in foreign subsidiaries so engaged.

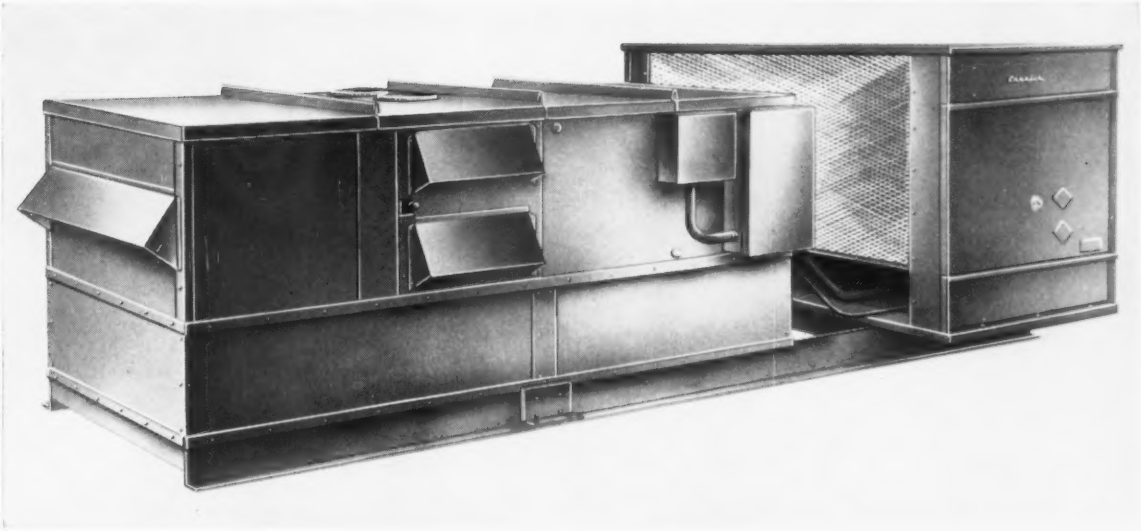
"An FBC would be exempt from U. S. tax on income derived from foreign sources in all categories (e.g. sales of goods or services, profits, dividends, interest, royalties, compensation for technical, engineering, and similar services). This exemption would be subject to the following limitations:

"1. Income derived from sources within the United States would be subject to United States tax.

"2. Income from foreign dividends, interest, and royalties would qualify for exemption only when received from a foreign corporation at least 10 percent of whose voting shares were owned by FBC."

It adds that existing foreign branches could be converted to foreign subsidiaries, wholly owned or owned jointly with others, "without U. S. tax consequences."

In line with these suggestions, Boggs has introduced legislation asking that "the Internal Revenue Code be amended to give special tax treatment to domestic corporations known as a Foreign Business



Carrier announces a

New Air-Cooled Commercial Weathermaker

- **PUTS BOTH HEATING AND COOLING OUTDOORS**
- **OCCUPIES NO VALUABLE FLOOR SPACE**
- **USES ONLY A MINIMUM OF DUCTWORK**

Here's the latest advance in heating and cooling for one-story buildings—the new Carrier 48B Air-Cooled Weathermaker*. Designed for roof-top installation, it provides the benefits of year-round air conditioning without the cost of extensive ductwork and without tying up one inch of floor space.

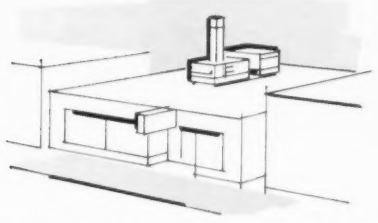
This versatile unit consists of a gas-fired heating section, a fan section and an air-cooled refrigeration section for cooling—all enclosed in a weatherproof casing and mounted on rails. Two capacities fit most heating and cooling requirements—7.5 and 10 tons for cooling; 200,000 and 250,000 Btus for heating.

Basically the 48B is a one-piece unit, but rigging and handling are simplified by shipping the unit in two sections (base unit and fan section). It also installs with a single supply and return air duct, thereby requiring only one duct passage to be cut through the roof. Installation is further simplified with only three service connections.

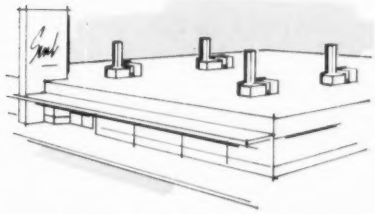
Besides the new 48B for heating and cooling, there's also a new unit for cooling only—our model 50AA. For information call your Carrier Dealer, listed in the Yellow Pages. Or write Carrier Corporation, Syracuse 1, New York.

* Reg. U.S. Pat. Off.

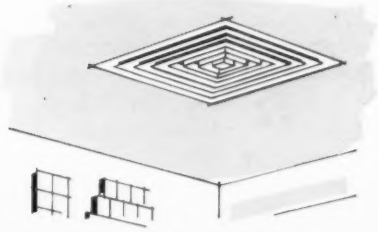
A few applications illustrating the 48B with chimneys, an optional accessory



A single unit will both heat and cool a small store or plant



Large buildings require two or more units to heat and cool

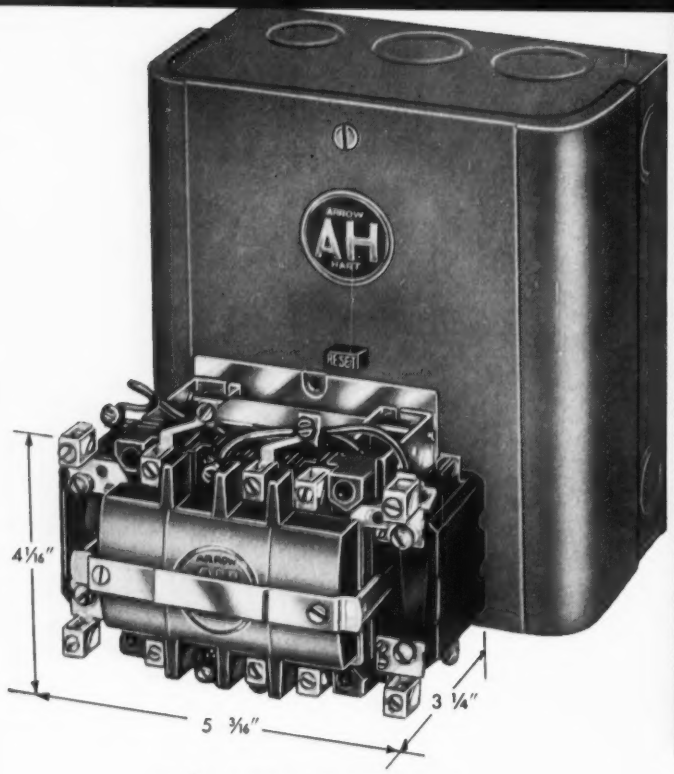


One supply and return air grille fits flush to ceiling

MORE PROOF OF

BETTER AIR CONDITIONING FOR EVERYBODY *EVERYWHERE*

Carrier



1/2 THE SIZE OF CONVENTIONAL STARTERS

NEW MODEL 58 "RA" STARTERS

Featuring the exclusive Arrow-Hart "Right Angle" Mechanism, with the magnet operating through a simple bellcrank lever. The resulting mechanical advantage lets a smaller, lighter magnet outperform older, direct-acting types — makes it possible to cut starter size in half while improving performance. Easily placed in equipment cavities or on crowded panels, these compact starters help solve design problems and pack top performance into small space. Other important "RA" features include:

- **NEW WIDE VOLTAGE RANGE COILS** . . . for Sizes 0, 1 and 2, with 1 coil now replacing 3 of the older type. STANDARD COIL VOLTAGES: 110-120, 208 230, 440-480, 550-600 VAC, at 60 cycles. New epoxy resin encased coils afford better protection against abuse and environmental conditions.
- **SIMPLE INSTALLATION AND MAINTENANCE** . . . with straight-thru front wiring, easy contact accessibility, and new wrap-around enclosures for Size 1.
- **A COMPLETE LINE** . . . including Sizes 0 through 5.

Write today for your free copy of Catalog 14: Arrow-Hart & Hegeman Electric Co., Dept. CE, 103 Hawthorn St., Hartford 6, Conn.

- **Have you seen Arrow-Hart's new 30 and 50 amp, 250 V, 4-wire grounding receptacles?**

ARROW AH HART

Quality since 1890

MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

ARROW AH HART

Corporation (FBC), such special treatment to have the effect of deferring payment of U. S. income taxes on the profits of an FBC arising from foreign investments and operations until those profits are actually distributed to U. S. stockholders or otherwise diverted from foreign uses."

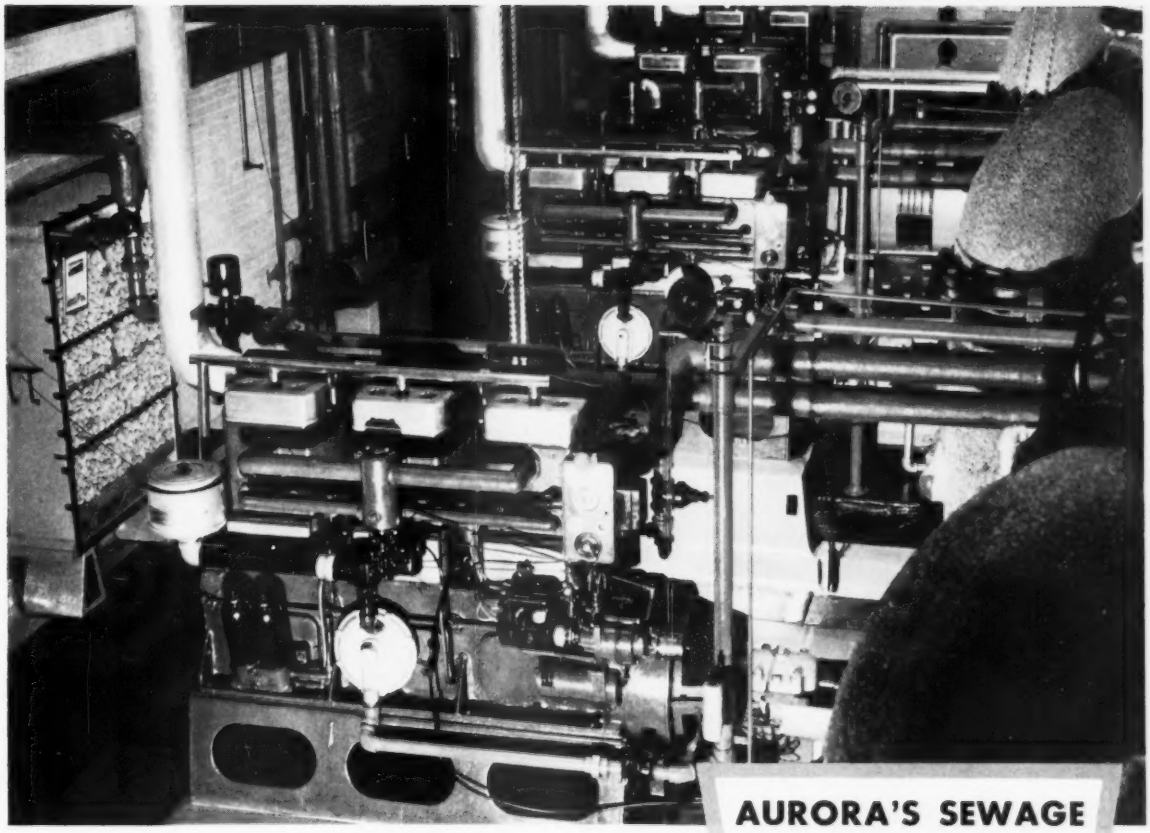
Twofold Possibility

The passing of this bill would be a double boon to consulting engineers. In addition to giving them a tax advantage on foreign work, it would encourage U. S. industry to expand foreign operations.

The report explains, "We favor a system of tax deferral instead of tax exemption or tax reduction because either of the latter would cause a permanent revenue loss without important reciprocal incentives to foreign investment."

In pointing out the FBC advantages, the report states that "A Foreign Business Corporation would, we believe, stimulate foreign investment by U. S. firms by permitting eligible companies to defer their U. S. tax on income accumulated abroad, provided such income is reinvested abroad. In addition, the proposed FBC would enable companies operating abroad to integrate the management of their foreign activities, to decide without regard to tax considerations whether to operate abroad through a U. S. branch or through a foreign subsidiary, and to transfer their foreign earnings from one country to another without tax liability."

Sometimes foreign taxes are worse (or as bad as) U. S. taxes, and the writers of the report also had a suggestion here. "We have concluded that the best practical way of dealing with this problem is through the negotiation of tax treaties, where the full effect and impact of particular foreign taxes can be examined." (Under present law, U. S. taxpayers can credit foreign taxes "in lieu of" U. S. income taxes. But some nations have such



AURORA'S SEWAGE TREATMENT PLANT has been POWERED by these

for over 22 years

CLIMAX ENGINES

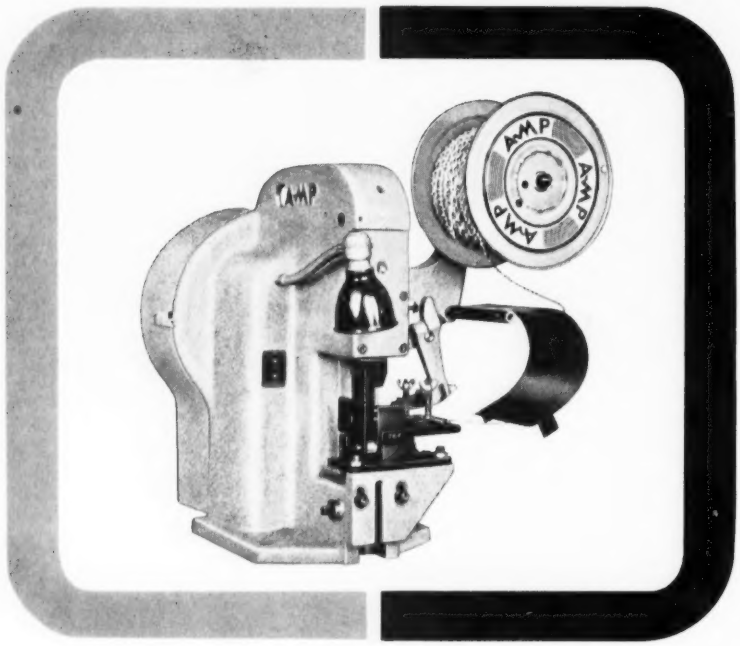
The Aurora Sanitary District, Aurora, Ill., installed two 75 hp, six-cylinder Climax pump engines in 1936. These direct-connected engines performed so well—always starting under load—that, in 1940 two 50 hp Climax engines in generator sets were added. All four engines had sewage gas and gasoline carburetors. In 1953, gasoline was replaced by natural gas as standby fuel. This gave the plant four-way safety—duplicate engines . . . two fuels . . . two ways to start generator engines . . . freedom from electric storm interruption. After 22 years, 8 months, pump engines had paid for themselves 4.78 times; generator engines 2.5 times after 17 years. Year after year Climax engines keep on making records like this. 40 to 610 hp; V-type—four models, 8 and 12 cylinder; in-line type—four models, 4 and 6 cylinder. Capable of operation on sewage gas, natural gas, butane, gasoline, or any combination. Send for complete power chart and bulletins.

CLIMAX ENGINE MANUFACTURING CO.
DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY AT CLINTON, IOWA

CL-104

FASTER

THAN YOU CAN SAY "CIRCUIT TERMINATION BY AMP"



Speed—amazing speed—is fundamental with AMP's tool-and-terminal technique. In fact, an A-MP automachine can turn out 4,000 terminations per hour.

No extensive operator training is required. And, no large floor space—the bench-mounted Automachine takes up less space than an ordinary desk. It's built for safety, built for speed, built for reliable production day after day. And A-MP Automachine terminals are made in a size and shape to fit every requirement with such features as corrosion resistance, vibration resistance, and, if required, pre-insulation. Furthermore, actual costs of the AMP method are lower than any other method.

Why not learn more about this world famous compression-attachment method? Send for our descriptive literature.

AMP INCORPORATED

General Offices: Harrisburg, Pennsylvania

A-MP products and engineering assistance are available through subsidiary companies in: Canada • England • France • Holland • Japan

a beautiful variety of taxes that it sometimes is difficult for the Bureau of Internal Revenue to decide just what should fall under the "in lieu of" clause.)

The report also suggests that arrangements should be made with foreign nations, during negotiations, to follow our example of tax deferment on reinvested earnings.

Currency Fluctuations

What about losses due to devaluation of foreign currency?

The report makes the formal recommendation that "existing law be clarified to provide that the loss due to exchange rate change, required by the Securities and Exchange Commission to be shown in published financial statements, also be recognized as an ordinary loss for tax purposes."

Under the present law, engineers willing to accept stock or securities as payment on foreign work have to pay a tax before receiving any cash payment. "We recommend a change in existing law so that where technical services are rendered in exchange for the stock or securities of companies in the less developed countries, the U. S. tax will be deferred until the stock or securities are sold."

For some badly needed development abroad, the government might provide the initial financing, either later leasing the project (in the case of an industrial development) or later giving the prime contractor an option to buy, with a little pressure on his investing as an indication of his interest in the betterment of the world. "The (prime) contractor could be encouraged, as consideration for such an option and as an earnest (sic) of its interest in the project, to contribute some of its own funds to the cost of the project to be credited against the option price. Conceivably some form of incentive to efficient management could be provided in the fee or other terms of the contract. Nevertheless, the project, until such an option was exercised, would be

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Your American-Standard* Industrial Division representative can usually put his finger on what you're looking for in a hurry. He knows his products and what they can (and can't) do.

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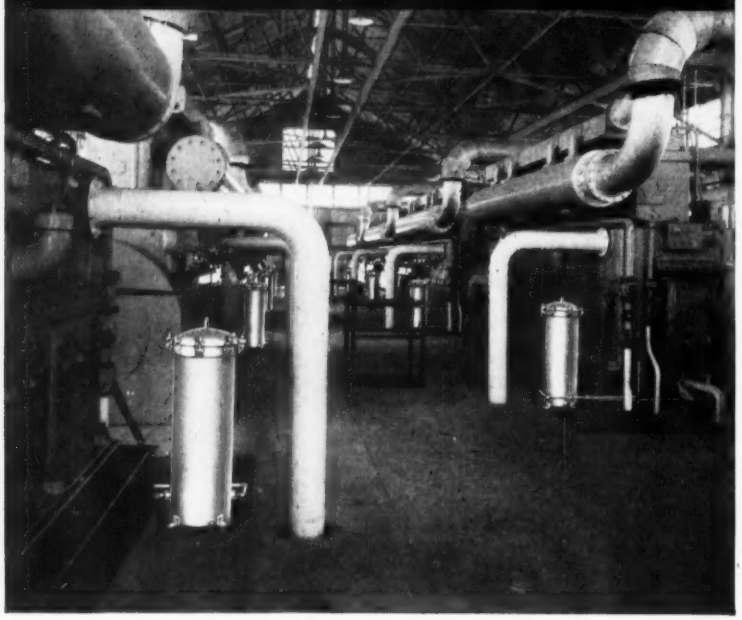
NUGENT FILTERS

Keep Lube Oil Clean for El Paso Natural Gas Company



Twenty-seven gas engine compressor units, each equipped with a Nugent Lube Oil Filter, have been in service at the Goldsmith plant of El Paso Natural Gas Company since 1949.

Excellent bearing, ring and cylinder wear maintenance records are positive proof that Nugent Filters have performed an outstanding job in keeping lube oil clean . . . free from sludge, acidity and harmful impurities that can accelerate wear and shorten engine life.

For safe, effective filtering protection for your valuable equipment . . . always specify Nugent Fuel and Lube Oil Filters . . . available in a wide range of types and sizes. Write for descriptive literature.

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OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

wholly government-owned and must be regarded as a government and not a private project."

Guaranty Contracts

At present, the Mutual Security Act guarantees a limited amount of overseas investment against losses that might occur due to expropriation, non-convertibility of earnings, and war damage.

"About $400 million in guaranty contracts have been issued. The program has resulted in a fee income of over $3 million, without a single call having been made on the guaranties during the 10 years of the program's operations. Pending applications are in excess of $1 billion."

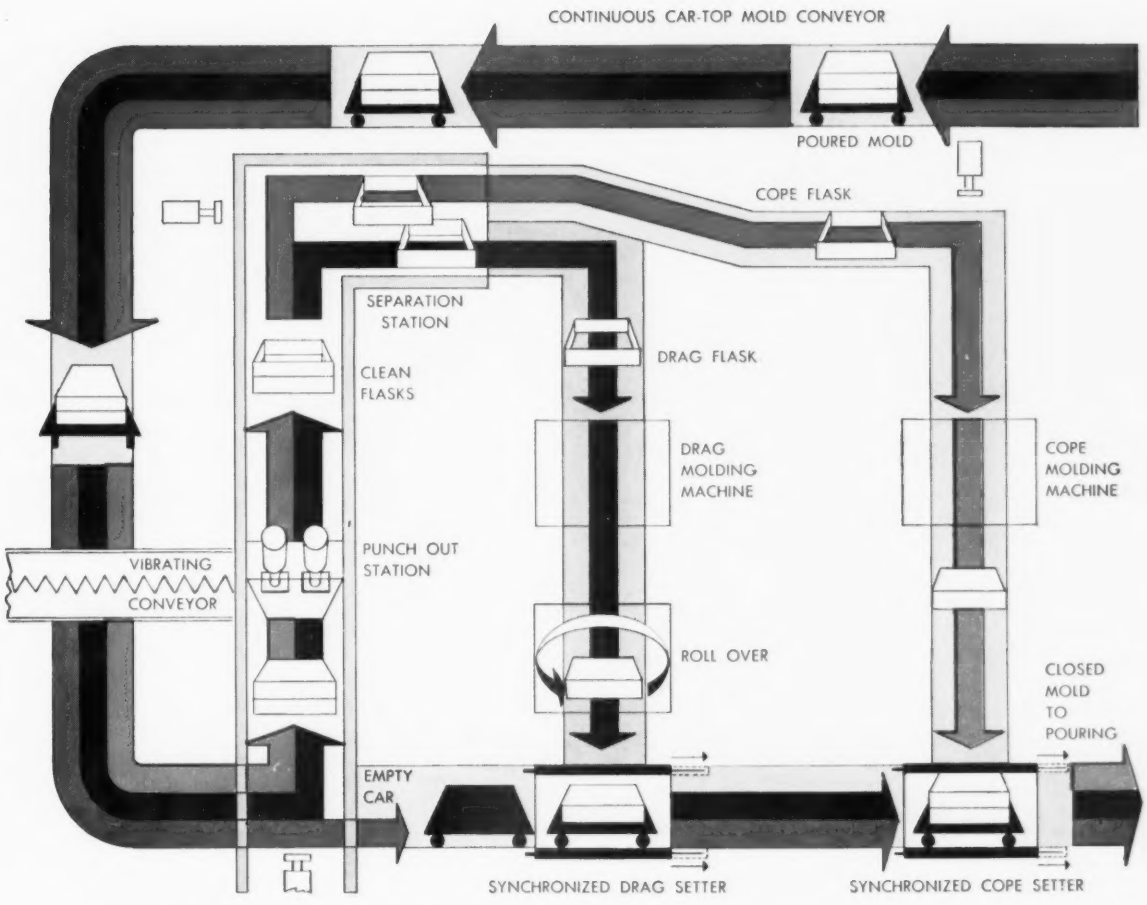
But, the report adds, "Based on the current rate of guaranty applications, the present ceiling on outstanding guaranties, $500 million, will soon be exhausted."

The report recommends that the provisions be broadened to cover something like $1 billion in contracts, and also that losses arising from revolution, insurrection, or civil strife be covered.

Feasibility Studies

Feasibility studies, if it appears they have a good chance of immediate utilization, are advocated. "Despite the well-known shortage of capital in less developed countries, there appears to be an even greater shortage of specific, well-planned industrial projects seeking to attract capital. Thus, there is considerable need and scope for a more active U. S. Government program to assist the developing countries to identify opportunities for private foreign investment and to bring them to the attention of potential investors.

"In underdeveloped countries, where the concept of the long-term risk taking is not deeply embedded, the idea of spending thousands of dollars on technical and exploratory work that is not certain to show a return is a radical departure from the traditional way



NEW AUTOMATIC MOLD HANDLING SYSTEM

..ANOTHER EXAMPLE OF PLANET VERSATILITY

Custom designed systems, such as the automatic mold handling system shown in the above diagram, have helped build Planet Corporation's reputation throughout industry as a *versatile* organization . . . as an organization with solutions to the most perplexing production, materials handling and automation problems.

This system, installed in a large automotive foundry, automatically handles molds from start to finish. After molding, the drag and cope flasks are brought together and gently and accurately closed in position for pouring. Following pouring, the castings and sand are punched out, the clean flasks are separated and recirculated through the system . . . *a system which will pay for itself in less than one year.*

This is only one example of "PV" . . . *Planet Versatility.* Planet "PV" engineers have automated many types of production lines, built bulk and unit materials handling systems, designed complete plants, developed the world's only true universal transfer device . . . in fact, they are experts on all types of special handling and automation machinery, and materials handling equipment.

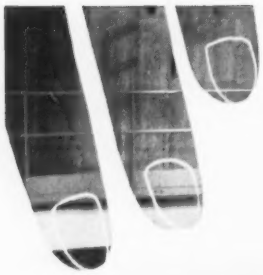
No matter what your problem . . . no matter how big or difficult your problem, "PV" will save your time in finding cost-saving, efficiency-increasing solutions. Let Planet demonstrate how its versatile engineering skill, and production and erection know-how can help you . . . you'll find *it pays to plan with Planet.*

PLANET CORPORATION

910

• Engineered Handling Systems
• Automation Equipment
• Mill & Foundry Handling Equipment

1823 SUNSET AVENUE
LANSING, MICHIGAN



"push button" access locks eliminate human error

Henry Pratt access locks at MIT Test Reactor

Absolute integrity is assured any Nuclear Reactor Containment Vessel when Henry Pratt Co. Access Locks are provided. Completely automatic, these unique safety devices are interlocked so that entrance and exit to the vessel is accomplished with ease, in 25 seconds, with complete safety.

The knowledge and experience gained through installations at Vallecitos (GETR), Arco (EBR-2), M.I.T. (test reactor), Ispra, Italy (CNRN) and others, has enabled the Henry Pratt Co. to offer a complete line of standard sizes for both personnel and equipment in high pressure and low pressure design.

Among exclusive Henry Pratt Co. Access Lock features are:

1 Inflatable Seal Personnel Air Locks. Either round or rectangular. Only one second is required to inflate or deflate the seal from readily available plant air supply. Emergency inflation can be provided by standby nitrogen tanks or air reservoirs. Push button actuated, only proper sequence of buttons will operate doors. Eliminates error. Flush-floor doors for easy passage of personnel or hand-trucks. Features pressure equalizing valves which prevent radical pressure changes within lock.

2 Inflatable Seal Equipment Locks. Design provides 8′ x 10′ opening. Flush mounted doors permit use of full area for equipment passage. Features pressure equalizing valves which prevent radical pressure changes within lock.

3 Compression Seal Personnel Air Lock. High pressure design up to 45 psia. Rectangular 3′-6″ x 6′-8″ passage. Conforms with ASME non-fired pressure vessel code. Features pressure equalizing valves which prevent radical pressure changes within lock.

The Henry Pratt Co. is also a pioneer in the design and manufacture of butterfly valves and expansion joints for the Nuclear Industry. A competent group of sales engineers are located in key cities. In Europe, represented by Ateliers J. Hanrez, Societe Anonyme, Monceau-sur-Sambre, Belgium.

Bulletin 451-J, soon to be published, fully explains these and many other advance features of the 25 standard sizes available in fully automatic or manual design. Be sure to write for your copy today.

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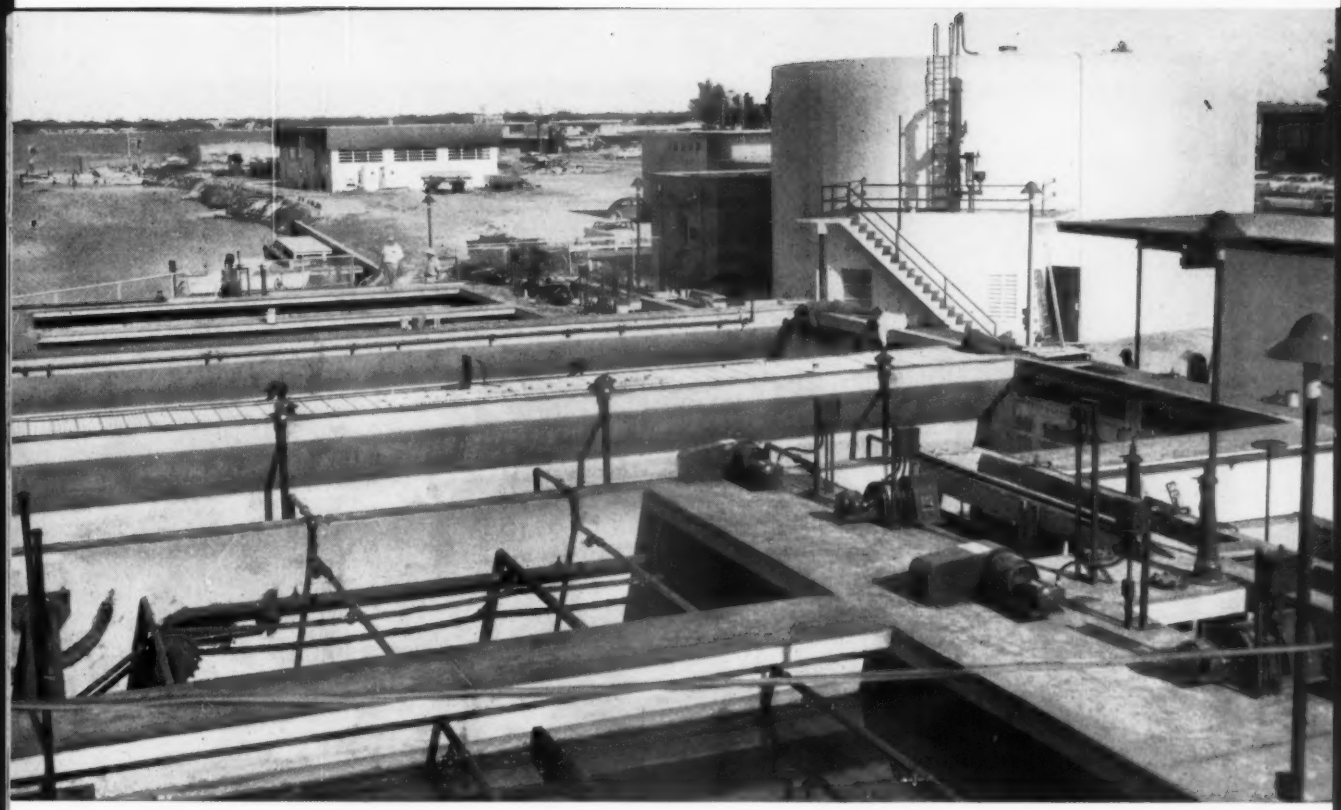
of doing business, and only a small minority of the businessmen in these countries have the means or the desire to take such a step. Because of this unwillingness to spend on technical preliminaries, many projects that might otherwise be of interest to American or other private investors die or remain dormant . . . Some are eventually undertaken as government projects.

"There should be some expansion, on a selective basis, of U. S. financing of surveys, normally by private American consultant firms, to identify and broadly evaluate in particular countries the most promising general fields or specific projects for private investment and their relative priority in terms of the country's over-all economic growth. The contractural arrangements for such surveys would be most effective if made between the private organization and the foreign governments or local development-promoting institutions.

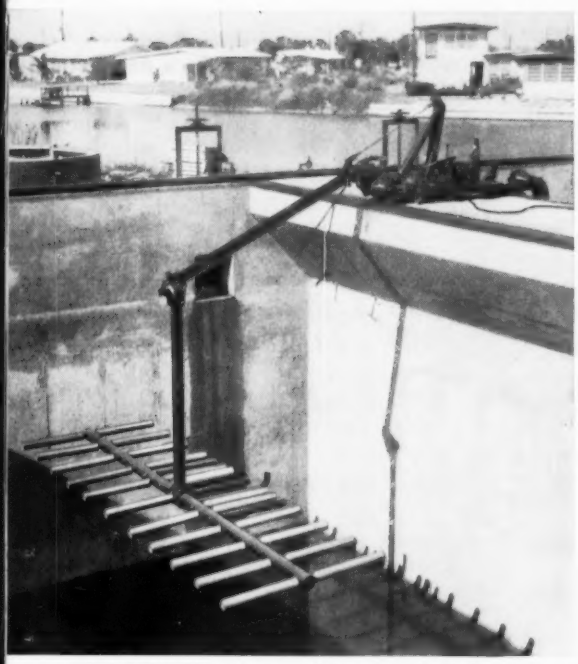
"Surveys should be conducted only where adequate information is not available, where there is a basis for believing that private investment could effectively contribute to the country's economy, and where there are reasonable grounds to believe that the surveys can be put to early practical use rather than adding to the already overly large library of unused studies. In this connection, it would be desirable after completion of the survey for the consultant firm to be retained on an 'as needed' basis so as to utilize its experience in dealing with future problems related to the subject of the survey.

"For a limited number of project possibilities of high priority, a program should be adopted for financing part or all of a potential investor's actual costs of detailed exploration, including such matters as market surveys, studies of availability of labor and raw materials, site location studies, engineering studies, preliminary design, cost analyses, financing arrangements,



More than five miles of extra heavy galvanized Wrought Iron Pipe, from 1½-inch to 3½-inch, were used in the construction of the Treasure Island, Florida, Sewage Collection Plant.

Wrought Iron Pipe provides a bulwark against corrosion at Florida's Treasure Island Sewage Treatment Plant



Included in this system are eight pneumatic ejector lift stations which are supplied with compressed air transmitted in Wrought Iron Pipe from the blowers and storage located at the Treatment Plant.

Compressed air piping used in the activated sludge process must provide maximum operating life, minimum maintenance.

At the new Treasure Island, Florida, Sewage Treatment Plant, consulting engineers specified corrosion-resistant Wrought Iron Pipe for this service. Severe internal corrosion and clogging from loose rust occur with ordinary piping materials in this service. But not with Wrought Iron. Its corrosion product is dense and highly adherent, and actually *protects* the underlying metal from further corrosive attack.

Today, consulting engineers and plant operating men are getting a Wrought Iron that is the most versatile material yet developed to help fight corrosion. New 4-D Wrought Iron faces corrosive attack with far greater resistance, even, than standard Wrought Iron, its dependable predecessor.

4-D was achieved by substantially increasing the deoxidation of the base metal, slightly increasing the phosphorous content and using a more siliceous iron silicate. 4-D is available now from nearby distributors. Write us for new 4-D Wrought Iron literature. A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

City of Treasure Island Sewage Plant Improvement
Consulting Engineers: Gilbert W. Clifford & Associates
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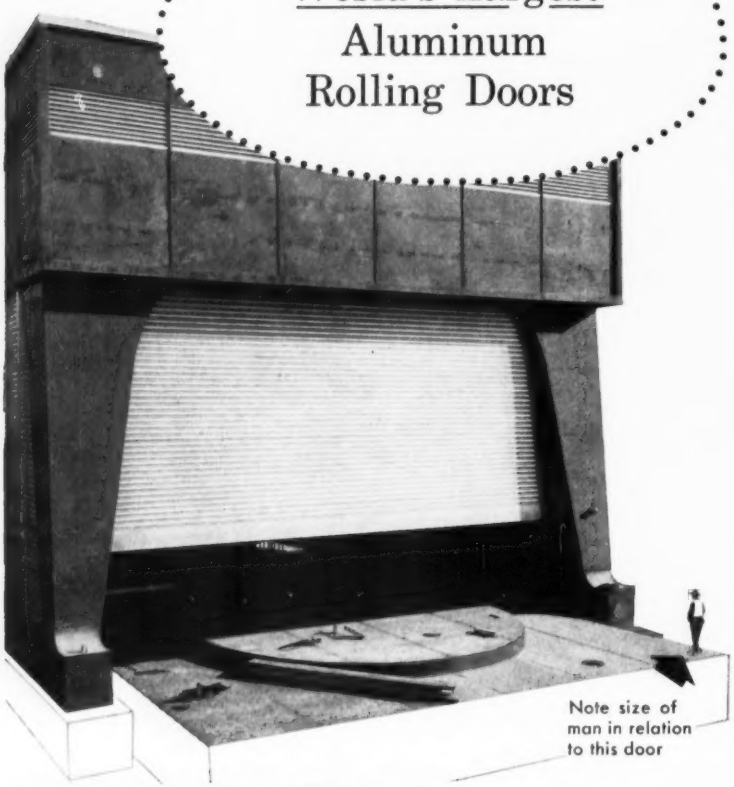
BYERS 4-D WROUGHT IRON

TUBULAR AND FLAT ROLLED PRODUCTS

ALSO AMBALLOY ELECTRIC FURNACE QUALITY STEELS AND PVC PIPE AND SHEET

Corrosion costs you more than Wrought Iron

World's Largest
Aluminum
Rolling Doors



Another unusual installation of

KINNEAR Rolling Doors

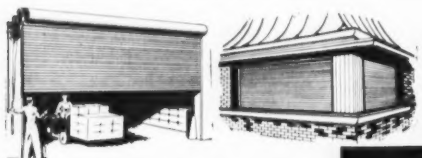
In 60 years of making metal rolling doors for industrial and commercial openings of every kind, we believe these are the largest ever made of aluminum.

Two doors 48 ft. wide and 39 ft. high enclose opposite ends of this 300-ton traveling gantry crane at the Robert H. Saunders — St. Lawrence generating station of the Hydro Electric Power Commission of Ontario. Similar Kinnear doors are used in New York's Robert H. Moses Power Plant, also part of the St. Lawrence project.

The doors are opened electrically as the crane is positioned over one of several open hatches in the generating station . . . then closed to permit working inside in any weather.

The space-saving efficiency and all-metal protection of Kinnear Rolling Doors cut costs in all kinds of openings — from counter-top areas to large industrial service doorways, as shown in the sketches below.

Every Kinnear Rolling Door is also REGISTERED — full details and drawings are kept in Kinnear's own fireproof vaults. *Your Kinnear doors are never obsolete, even if they serve for half a century or more — as many Kinnear doors have.*



Kinnear Rolling Doors are built any size, of steel, aluminum or other metals. Motor operation, with push-button control, if desired. Write for full details.

The KINNEAR Mfg. Co.
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KINNEAR
ROLLING DOORS
Saving Ways in Doorways

studies of applicable legal requirements and political conditions, and salaries, travel, and subsistence of personnel engaged in making or arranging for such studies.

"The advance would have to be repaid only if the borrower went forward with the project. If it elected not to go forward, all studies, reports, data, and technical information developed in connection with the project would become the property of the United States, which could make them available without limitation to other potential investors and to the government of the country concerned."

Diplomatic Support

More good news for the consultant stems from the statement that "Americans doing business abroad deserve the strong diplomatic support of their government."

The report then talks of "One of the most important functions of the Foreign Service officers engaged in economic and commercial work abroad is to receive American businessmen and to give them prompt, courteous, and efficient assistance. This includes providing general economic information and specific commercial and investment information and making introductions to local businessmen and government officials."

(And maybe letting consultants know about forthcoming projects before they read an announcement that some foreign firm already is doing the design?)

Methods of Approach

The report suggests at least two avenues of approach for the consulting engineer.

First, it asks that "Efforts of American missions abroad to improve their services would be facilitated if business representatives who felt that they had not received adequate support and assistance gave full particulars to the Departments of State or Commerce." Consultants would have no trouble presenting a long list of foreign proj-

NEW... by CROUSE/HINDS

ARK-trol®

ELECTRICAL CONNECTORS

• Foolproof polarization • Errorless assembly • Maximum interchangeability • Environmental: Exceed rigid military and industrial requirements for resistance to corrosion, chemicals, high and low temperatures, pressure, shock, vibration, dust, humidity, moisture, and leakage of air.

POSITIVE POLARIZATION

Completely foolproof: plug can be mated only with proper receptacle, and in only one way . . . the *right* way. Unsymmetrical contact arrangements preclude improper mating of contacts, or mating of unmatched contact configurations.

FAST, EASY, ERROR-FREE ASSEMBLY

Polarization keyways and unsymmetrical contact arrangement in insert assemblies make improper assembly of parts impossible. One-piece 'snap-in' connectors. Soldering is done outside . . . *before* insertion of contacts.

SEALED AGAINST ENVIRONMENTAL FACTORS

'Stack' assembly includes silicone rubber wafer for impenetrable seal against water, vapors, dust, gas. Basic shells, other metal parts are high-strength extrusions of aluminum alloy, anodized for corrosion, abrasion resistance: 1800 volts are required to penetrate this coating.

MAXIMUM INTERCHANGEABILITY

Components in each diameter are interchangeable and reversible, doubling scope of equipment. Male *and* female shells take either pin or socket inserts: both plug and receptacle may be used 'hot' or 'dead'. Pin and socket configurations available in wide range . . . specials supplied on request.

SHELL SIZES and ELECTRICAL RATINGS

Four shell sizes: from 1-1/16" to 2-9/16" diam. *Voltages:* Military Service Ratings: A, D, E, B, C and Instrument. NEC Rating: 600V. A.C. *Contact sizes:* #16 to #4/0 inclusive. Write for Bulletin 2711 containing complete descriptions, specifications and configuration patterns for both Type RPE and RPC *ARK-trol* Electrical Connectors.

Available in two types:

TYPE RPE ENVIRONMENTAL
- Moisture Proof
- Shock Insulated
- Dust-Tight
- Corrosion Resistant
- Grounded & Non-Grounded

TYPE RPC CIRCUIT BREAKING
- All Features of RPE *Plus* . . .
- Circuit Breaking under full Rated Load

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doesn't cost...it pays!

Removes feed water oxygen to a guaranteed .03 cc/liter

Assures a simpler system that costs less to own and operate

The Schaub .03 is, in fact, one of the simplest deaerators ever built, designed around a unique and more efficient operating principle that removes oxygen to an actual and GUARANTEED .03 cc/liter.

Fully vented operation at atmospheric pressure — combined with pinpoint temperature control and Schaub "live action" heating of storage water — provides a forceful breakaway of air molecules that assures more effective oxygen removal under widely varying load conditions. At the same time the special Schaub spray contact vent condensing principle practically nullifies steam losses.

The Schaub .03 is completely safe! It needs no premium cost pressure shell construction—requires neither adjustment nor attention during operation—and takes practically no maintenance whatever! Even the exclusive Chromasoid lining is guaranteed against shell corrosion failure for 10 years.

Finally, no pressure-vessel insurance premiums to pay — ever!

Whether you reckon in original cost or the operating savings you'll achieve, no other deaerator in the 3000 - 45,000 lb. range offers you so much protection for so little. For fuller information on the remarkable "hows" and "whys" and savings advantages of the Schaub .03 Deaerator method, send for Bulletin 1300.

FRED H. **SCHAUB** ENGINEERING COMPANY
2103 S. Marshall Boulevard, Chicago 23, Illinois

Please send me, without cost or obligation, my personal copy of your Bulletin 1300 on Boiler Feedwater Deaeration.

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ects that have not gone to American firms because they received too little information too late.

The second possibility comes through a formal recommendation that "a senior official at an appropriately high level within the Department of State, and supported by the necessary staff, be assigned responsibility for assuring fullest possible use of private enterprise in foreign economic development."

In explaining the duties of this "senior official," the report suggests that "He should also maintain close contact with the private financial and business community on broad policy problems. It may be desirable to establish a panel of consultants drawn from outside the government who would be available as and when necessary." Will this panel include a consultant?

Package Contracts

And now for a rather important cloud on the State and Commerce Department horizon. "We recommend that, where necessary to accomplish high priority projects, greater use be made of management contracts which centralize managerial responsibility for an entire project, including its operation for an initial period, in a single operating company; and that these contracts be developed in cooperation with foreign governments."

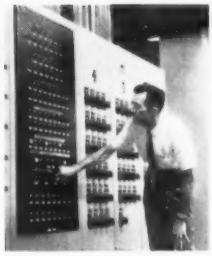
In explaining the reasoning behind this, the report adds, "Present foreign aid contract regulations and techniques encourage a segmented approach to contracting. They encourage separate contracts for feasibility studies, architect-engineer services, and construction, as opposed to centralizing managerial responsibility for an entire project in a single company. These policies also lend themselves to the selection, as prime contractors, of architect-engineers and construction companies rather than companies with operating experience.

"There are important advantages in a management contract, follow-

Doctor's code flashing on Edwards Paging Annunciator, Fisher-Titus Hospital.

Edwards seven-circuit sectionalized Clock Control Board with Automatic Reset Control, Grady Memorial Hospital.

Edwards Doctors' In & Out Register and Flush-Mounted 12" Clock. Operator places call on Silent Paging System, Fisher-Titus Hospital, Norwalk, Ohio.



Edwards Power Distribution Annunciator monitoring vital electrical systems at Grady Memorial Hospital.

500 name Edwards In & Out Register, Grady Memorial Hospital, Atlanta, Ga.

Manual alarm station of Edwards Fire Alarm System with Edwards fire alarm bell above, Fisher-Titus Hospital.

Edwards Nurses' Call Master Station Annunciator – emergency lamps, bell, and buzzers for standard operation. Edwards clocks and dome lamps in background, Grady Memorial Hospital.

Edwards Audio-Visual Nurses' Call Master Station. Mercy Hospital, Toledo, Ohio.

Edwards "Sta-put" Nurses' Call bedside button. Mercy Hospital.

For the consulting engineer who prepares hospital specifications:

DON'T OVERLOOK THE BENEFITS OF MODERN SIGNALING SYSTEMS

Edwards specializes in modern signaling systems for control, communication and protection in hospitals, manufacturing everything from Protective Annunciators for vital power systems to Nurses Call Systems. These systems make a significant contribution to the efficient, safe and convenient operation of any institution. In their development special emphasis has been devoted to long life, simplicity, and freedom from involved maintenance. Most important, Edwards systems are backed by a reputation built through years of specialized signaling service. Some typical applications are shown here.

Here's how we can help you fill your client's signaling needs:

Edwards signaling equipment for schools, hospitals, industrial plants and commercial buildings is readily available through electrical distributors throughout the country. Edwards technical representatives are always ready and able to work with consulting engineers when additional application or installation information is required. Why not write Edwards now for hospital signaling system engineering data—if further information is desired, the local Edwards technical representative is available on call.

EDWARDS

Specialists in signaling since 1872

CONTROL • COMMUNICATION • PROTECTION

Edwards Company, Inc.,
Norwalk, Connecticut

(In Canada: Edwards of Canada, Ltd,
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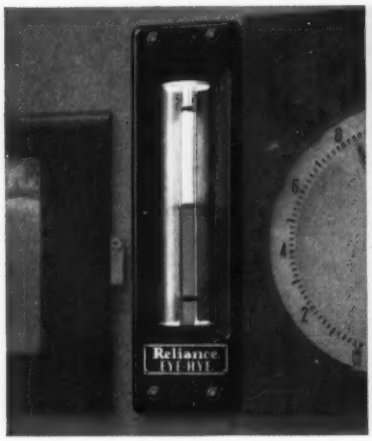
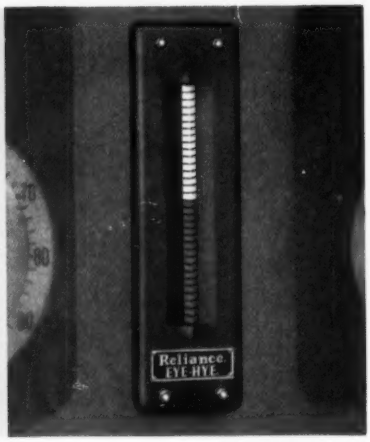
Safe, sure check on boiler water levels with wide-vision EYE-HYE

The remote gage with liquid indication



EYE-HYE for pressures up to 600 psi



EYE-HYE for pressures up to 3000 psi

Put your boiler water level supervision on a plane with other power plant control facilities — read levels at your control station with Reliance EYE-HYE.

The dependable accuracy of this popular remote reading indicator eliminates "boiler-climbing"; its bright green liquid-column image stands out — mistake-proof. And EYE-HYE's improved design provides visibility over a wide arc — lower pressure models up to 90°; new higher pressure models, to 180°.

Simple manometric design, with no mechanical parts and no adjustments on location. Available with economical special attachment to actuate supplementary alarms . . . Write for catalog information on EYE-HYE for *your* boiler pressure.

The UNITEMP, complete temperature equalizing unit furnished with each EYE-HYE

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The Reliance Gauge Column Company

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ing the necessary feasibility studies, whereby the U. S. or foreign government contracts with a single company to undertake on a cost-plus-a-fixed-fee basis to design and construct a plant, train local operating personnel, and operate the plant for a period such as 3 to 5 years. The full support and cooperation of the foreign government is vital to the successful use of this technique. Some of its advantages are:

"1. The judgment of an experienced operating company is obtained as to such matters as site selection, size and design of plant, and nature of product.

"2. Local personnel are given training in efficient production, sales, and distribution methods.

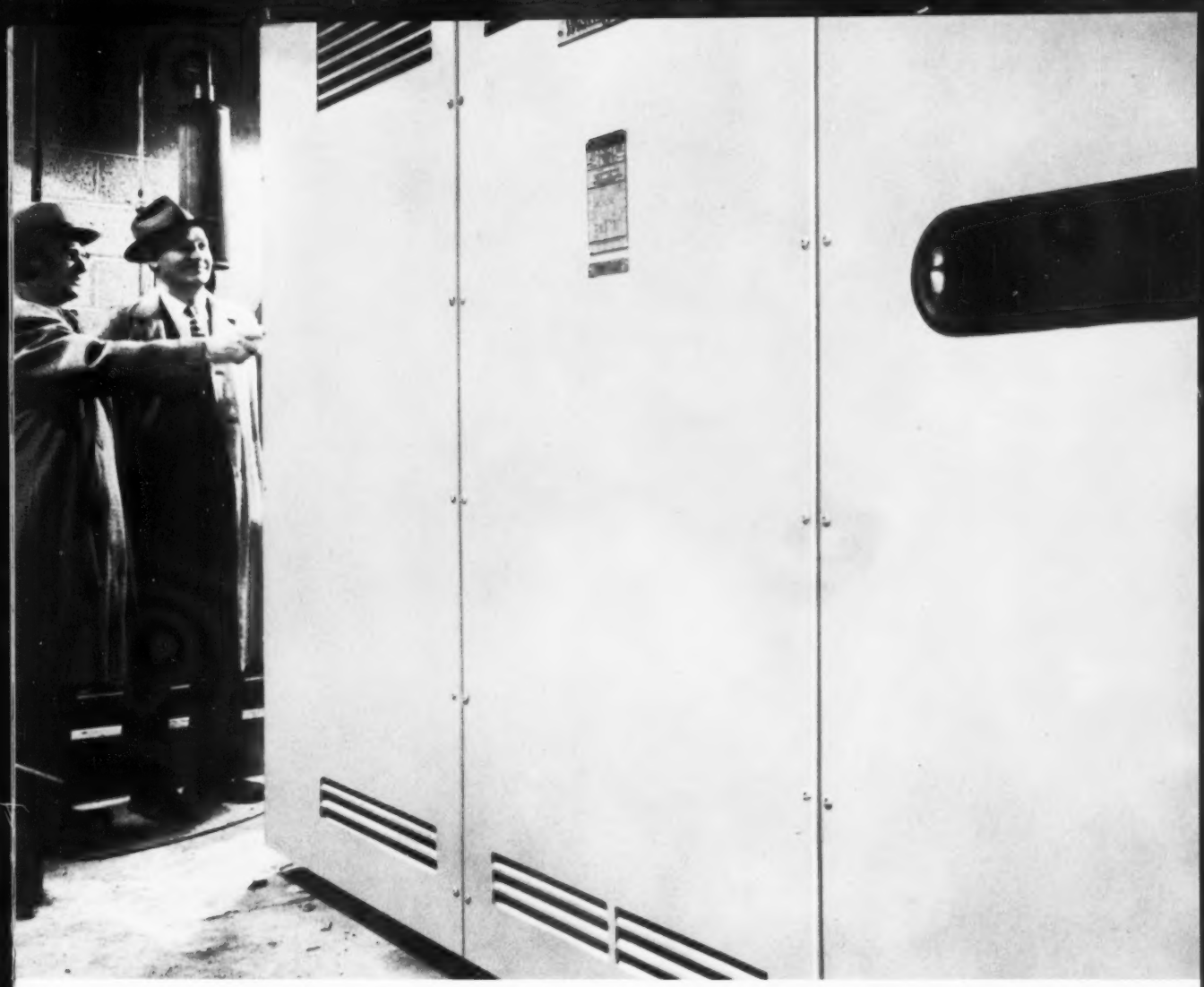
"3. The American management is enabled, at no out-of-pocket cost or risk to itself, to gain experience in foreign operations which, if favorable, could lead it to undertake other projects with its own funds and at its own risk.

"4. Contracts are made by the local community with private American businessmen and their operating methods which should help build up local acceptance and support for private investment and business activities."

At least the report writers seemed to realize they had a tiger by the tail in this portion of the study. "We have been unable to uncover any suggestions which will adequately meet the intrinsic difficulties of (the prime) contractor selection." ▲▲

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for $1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER, 217 Wayne St., St. Joseph, Mich.



These school board members, Treasurer W. R. Pool (left) and Mr. Harrison C. Kennedy, are enthusiastic about the safety and compactness of the Westinghouse Ventilated Dry-Type Power Center installed in Hickory Township High School, Hickory Township, Pennsylvania.

From the Westinghouse Full Line...

VENTILATED DRY-TYPE POWER CENTERS SERVE SCHOOLS SAFELY

For indoor installations—like this one at Hickory Township High School—where safety is a major factor, consider the advantages of Westinghouse Ventilated Dry-Type Power Centers.

Over 20 years' reliable, trouble-free service—in schools, hospitals, factories, institutions, airports, office buildings—have proved these Power Centers inherently safe . . . for personnel and equipment.

Westinghouse has a full line of self-contained Power Centers—one to fit every application, any installation. Whatever your power distribution problem—whether a change-over to higher voltage or a complete modernization of existing facilities—this full line makes it easier, more economical to POWER-UP for greater production, greater efficiency.

Any location—indoors or out, safe or hazardous, clean atmosphere or dust-laden—can be served better with a Westinghouse self-contained Power Center . . . ventilated dry-type, sealed dry-type or liquid immersed.

Interested in savings, too? . . . See overleaf:

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL DESI ARNAZ SHOWS" CBS TV MONDAYS

Architect Walter H. Frost (left), of Kling and Frost, Youngstown, Ohio, and Consulting Engineer F. E. Sturgeon, Grove City, Pa., with Hickory Township High School's new Power Center, a Westinghouse 3-phase Type ASL, rated at 500 kva, 12,470 to 208Y/120 volts, 60 cycles.

SAFETY... PLUS LOWER SOUND LEVELS, LOWER INSTALLATION AND MAINTENANCE COSTS

Safety of Westinghouse Ventilated Dry-Type Power Centers is inherent in their construction. With air-insulated core and coils, there is no danger of explosion . . . very low fire hazard.

Lower sound levels

These power centers are now available at reduced sound levels—up to 9 db below standard NEMA levels—making them even more suitable for indoor installations.

Lowest installation costs

These units can be installed virtually anywhere. No special safety precautions are required—no vaults, pressure-relief devices, outside venting, gas-absorbing equipment, catch basin or drains. Installation space is 35% less than for Inerteen®-filled units. Low weight makes balcony mounting practical, saving valuable floor space.

Lower maintenance costs

Maintenance cost is considerably less than for liquid-filled units. There are no gauges, valves or gaskets to maintain, no liquids to handle or recondition.

Single responsibility

Westinghouse assumes full responsibility for engineering, manufacturing and field service for every Westinghouse self-contained Power Center—and for each component.

Ask your Westinghouse distributor or local representative for the full story of the Ventilated Dry-Type Power Center . . . or the particular Power Center from the Westinghouse full line that best fits your needs. JI-70905

YOU CAN BE SURE...IF IT'S Westinghouse

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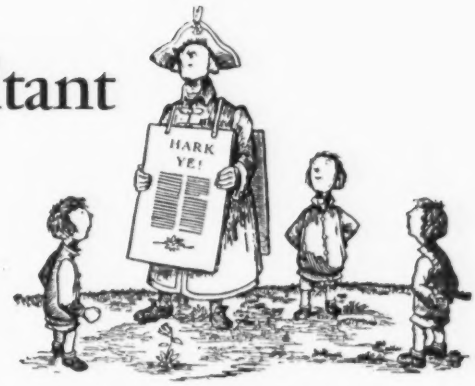
News for the Consultant



Consulting Firm Sells Stock

Lockwood, Kessler and Bartlett, Inc., of Syosett, Long Island, a consulting engineering firm which does no construction work, is selling its stock on the open market. The Long Island consulting firm, which specializes in highway design and also is well known for its photogrammetry, hopes to be listed on the American Stock Exchange by the end of the year.

Why did the firm "decide to go public?" John H. Mitchell, vice president and treasurer, explained that the new financial arrangement will have a number of advantages. First, it provides the firm with working capital and with the tools for future expansion and diversification — in the field of engineering, of course. Also, prior to the sale the firm's stocks had no established value. Now the company has marketable securities. Proceeds from the sale of the stock can be used to retire bank loans, and if desirable, to exercise the company's option to purchase its presently leased offices.

Most of the firm's preferred stock — 96.3 percent — is held by Ford Bartlett, president. He also has 40 percent of the Class B stock. Of the remaining Class B stock, J. J. Darcy, executive vice president, holds 10 percent, and Francis V. duPont, director, has 7 percent.

All of the stock placed on the market — 150,000 shares at $7 per share — is Class A stock. The Class B will be converted to Class A on a share for share basis in three equal amounts in 1962, 1964, and 1966. In the meantime, dividends on Class B are limited to 1 percent (on a per share basis) of any dividends declared on Class A.

Of the 150,000 shares sold, more than 15,000 were purchased by company employees. At present, the firm has no stock option plans, but it is being considered, Mitchell said.

Will engineers lose control of this engineering firm? Mitchell says it is impossible. Under New York State law, the chief executive officer of any corporation practicing engineering must be a licensed engineer or surveyor. Besides, the three company officers retained 57 percent of the stock, and by custom, all engineering design drawings prepared by the firm are stamped by an officer, giving him personal responsibility for the caliber of engineering work done.

Why did Lockwood, Kessler and Bartlett select this particular time to go on the open market? "No particular reason for the timing," Mitchell said. "This had been under consideration for more than two years."

According to the prospectus, contracts on hand last year-end were reported at $6,327,988 compared with $6,154,977 at the end of 1957. Of these amounts $4,240,427 had been earned as of Dec. 31, 1958, compared with $3,660,615 at the end of 1957. Net income after taxes in 1958 was $150,469.

Southern Italy's Growth

Cassa per il Mezzogiorno, the Southern Italy Development Fund, has borrowed $70 million from the New York investment market, the World Bank, and the European Investment Bank to continue expansion of its public works programs in agriculture, transport, and public health. The loans will help to finance the Mercure thermal electric power project south of Naples and two industrial projects

Rehabilitation program for southern Italy includes this recently completed Flumendosa Dam in Sicily.

IN MODERNIZATION

GRACIOUS LIVING CALLS FOR

THERMAL

When the Plaza Hotel in Houston planned to modernize its air conditioning system, Thermal multi-zone units were chosen to assure the year-around comfort of the Hotel's transient and permanent guests.

The Thermal line of quality equipment is famous for long life and efficient operation—which means it can be specified with confidence to deliver years of satisfaction. Thermal Engineering equipment includes central plant air conditioners, multi-zone air conditioners, cooling and heating coils, sprayed coil units, heating and ventilating units and air cooled condensers.

Detailed catalog available.

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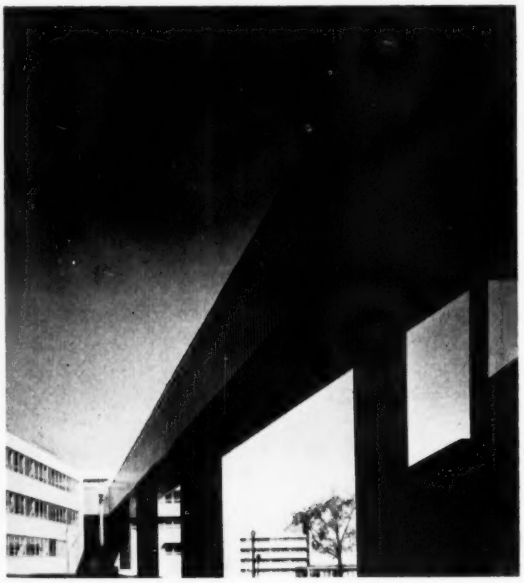
in Sicily, the SINCAT and CELENE petrochemical plants. All three jobs have high economic priority in the program for developing Southern Italy.

The Mercure project encompasses the construction of a 210,000-kw thermal-electric station on the Mercure River 120 miles southeast of Naples. The plant will burn locally available brown coal. This project forms part of a power expansion program conducted by a group of companies controlled by the Societa Meridionale di Electtricita (SME).

Aluminum Pedestrian Bridge

To connect an existing hospital building to the University of Michigan's new $8.5-million medical science building in Ann Arbor, Giffels & Rossetti, architect-engineers of Detroit, designed a 245-ft long enclosed bridge. Suspended 25 feet above the ground by center columns, the 12½-ft by 12½-ft concourse makes extensive use of fluted sections of aluminum panels. The architecturally graceful pedestrian span blends with the modern medical science building, the largest in the nation.



Aluminum pedestrian bridge at University of Michigan medical science building, designed by Giffels & Rossetti.

Manila Bay Facelift

The firm of Rader and Associates, Engineers and Architects, Miami, Florida, has been retained by the Philippine government to blueprint a $14-million program for the expansion and modernization of shipping facilities at the Port of Manila. This

Any way you look at it...

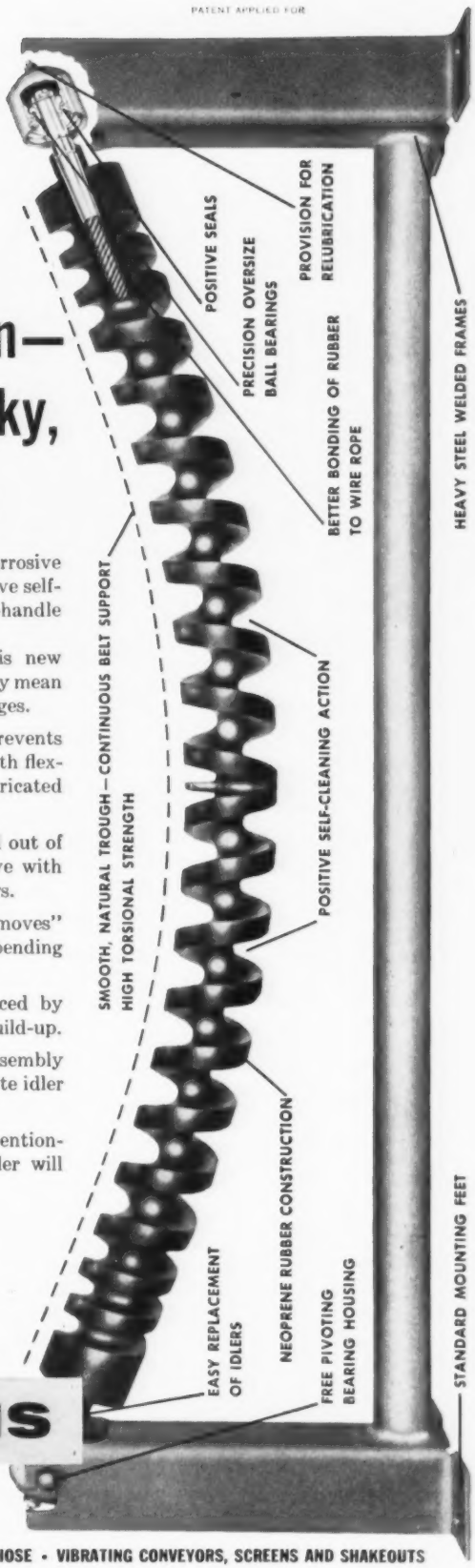
New Rubber Spiral Idler Defies Corrosion, Abrasion—Prevents Build-up of Sticky, Hard-to-Handle Materials

Here's the conveyor idler built to last longest in punishing corrosive atmosphere or extreme abrasive service! What's more, its exclusive self-cleaning rubber spiral prevents build-up of sticky, hard-to-handle materials!

The numerous design and construction advantages of this new Hewitt-Robins idler are shown in the illustration. Here's what they mean to you in terms of cost-cutting, time-saving, operating advantages.

- **LONG LIFE.** Neoprene spiral, completely covering wire rope, prevents attack in corrosive atmosphere. Uninterrupted spiral gives smooth flexing, maximum strength. Precision sealed bearings can be relubricated for still longer life.
- **SELF CLEANING.** As the spiral turns, it "works" any material out of the grooves as they change shape. This action is most effective with sticky materials which tend to build up on common types of idlers.
- **CONTINUOUS BELT SUPPORT.** The new rubber spiral design "moves" along the entire width of the belt; therefore, pinching and sharp bending of the belt are eliminated.
- **SELF TRAINING.** Belt training problems are greatly reduced by readily conforming rubber spiral, and by elimination of material build-up.
- **EASY REPLACEMENT.** The spiral, wire rope, and bearing assembly simply lifts out of its brackets—no tools are needed. The complete idler fits standard conveyor stringers.
- **TRUE OPERATING ECONOMY.** Under conditions where conventional idlers fail prematurely, the Hewitt-Robins rubber spiral idler will pay for itself many times over.

Deliveries of this revolutionary new idler are now being made in 18, 24, 30, and 36 inch belt sizes. For further information check your H-R distributor, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 6-13.



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- *1 7/16" thin, of light-weight, modern construction, when supplied with a straight edge and carrying case, becomes a self-contained, versatile drafting unit for desk or field.*

Light weight and thin design encourage use on regular drafting board, permit unit to be stored with reference books, ready for next use. It pays for itself in a short time.

- in addition to tracing applications, may be used to study interference and motion in superimposed layouts, to check detail drawings, or to trace on Multilith mats and strip in and opaque negatives. Also used to display or examine transparencies and x-rays.
- PORTA-TRACE fits under parallel rule on drafting board or may be supplied with locking T-Square, other attachments. Can be used with drawings larger than unit
- cool fluorescent lighting, stainless steel frame, shatter proof diffuser top, built-in switch, rubber feet—available in 5 sizes up to 36" x 48", starting at $32.50

Write today for complete information and prices!

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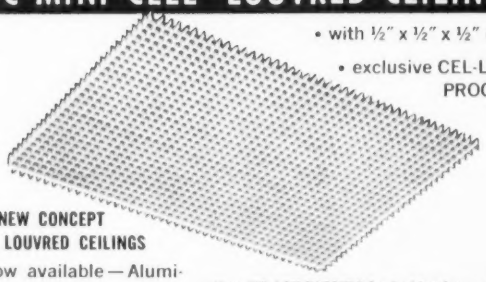
LEADER IN LOUVRED CEILINGS

ALUMINUM

SC MINI-CELL® LOUVRED CEILINGS



- with ½" x ½" x ½" cells
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- New CEL-LOK PROCESS for locking louvre blades at each intersection . . . guaranteed prefabricated alignment, dimensional stability.
- Visual comfort . . . high efficiency with Neo-Ray MINI-CELL louvres in Baked White Enamel . . . or Ripple-Tex for very low brightness.
- Easy-to-install inverted Tee-bar grid systems . . . louvres simply lay into position.
- Ideal for ceilings, skylites, air diffusers . . . many, many applications.
- Special sizes to 48" x 48" and larger.
- Available Neo-Matte Alumilite or other finishes on request.

Send for following literature: . . . New Product Bulletin N-58 (Mini-Cell)
. . . Sweet's Architectural File for 1959
. . . Louvred Ceiling Catalog No. 544

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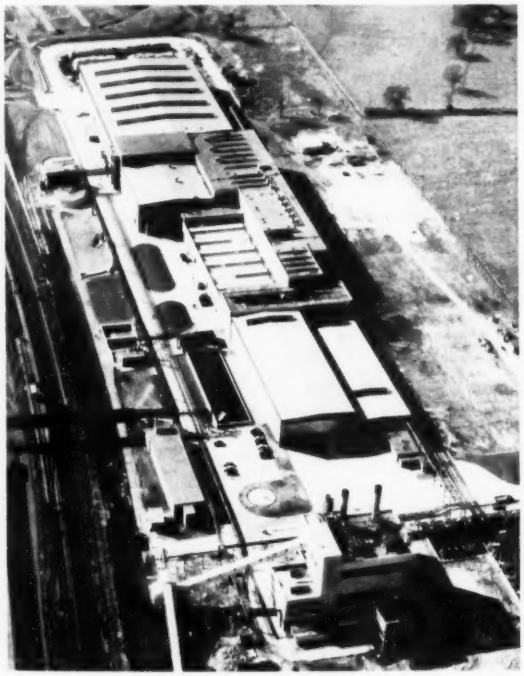
will include dredging of the channel and turning basin as necessary. Increasing Philippine commerce, bolstered by free trade relations with the United States, and rapid development of mining activities, industrial production, and hydroelectric capacity, have made the expansion program for one of the world's largest landlocked harbors a necessity. A feasibility report now being prepared will be submitted as the basis for a loan request to the Export-Import Bank for the project.

Huge Paper Board Mill

The chief problem in the construction of a $14-million paper board mill, recently brought into operation at Thatcham in Berkshire, England by the Reed Paper Group, was the low-lying and almost completely level conditions of the 40-acre site. Several streams intersected the site, and during spring these tended to overflow their banks, so before site clearance began they were diverted.

Normal spread type foundations were rejected as they would have involved deep excavations which might have affected the stability of the main rail line between London and the west of England, which runs along the southern perimeter of the site. Proximity of this railroad also limited the amount of water pumped from excavations, since excessive pumping would have drawn sand particles



Cast-in-place concrete piles, 2400 in all, support this new paper board mill at Thatcham in Berkshire, England.

Less than ¼ turn opens or closes

When you need...

- Quick action
- Leak-Proof Seal
- Minimum Pressure Drop
- Straight-through full flow
- Valves that cannot wedge or jam
- Self-grinding rotating disc

Specify Everlasting Valves

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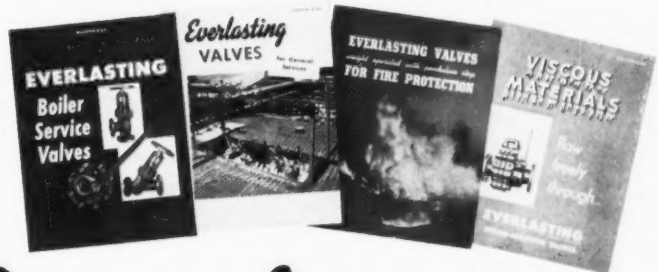
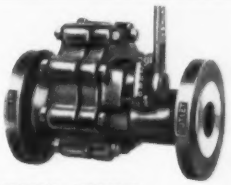


BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.



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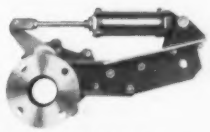
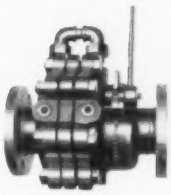
Where drop-tight seal and full flow is essential.



CYLINDER OPERATED
Can be remotely controlled, electrically or manually.



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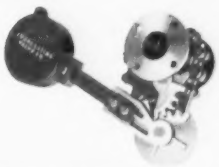
Assures free flow of viscous materials.



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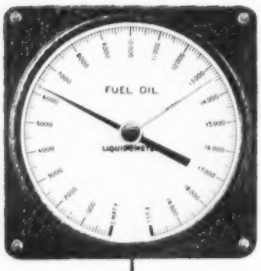

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Several sizes available. Approved by Underwriters Laboratories and Factory Mutual. UL approved switches.

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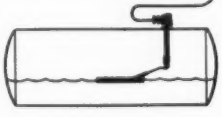

Since 1920 of proven quality

THE LIQUIDOMETER CORP.
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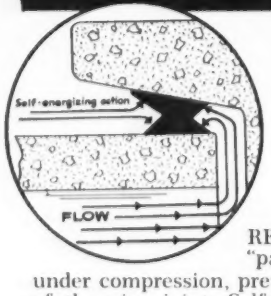
Self-Energizing REXON "K" GASKETS



✓ PREVENT LEAKS

✓ SPEED PIPE-LAYING

REXON "K" *Rubber* Gaskets "pack" the pipe joint tight under compression, preventing leakage in or out of the pipe joint. Self-energizing action causes Gasket to seal even tighter as water pressure increases. Made for standard bell and spigot concrete pipe, REXON "K" Gaskets "snap-on" to the pipe, and the pipe is quickly coupled into the line. Wet trenches do not delay the work. Made of acid-resistant rubber, they never deteriorate. REXON No. 2 PIPE COATING protects concrete pipe against deterioration by hydrogen sulphide gas, oils, greases and solvents. It is synthetic hard rubber which vulcanizes to pipe by catalytic action, *not* by evaporation which causes pin-holes. WRITE FOR MORE DETAILS. 5104

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out of the ballast ground stratum, also causing settlement or movement of the tracks.

Cast-in-place concrete pile foundations were adopted. In all, 2400 were cast, the average depth of boring being 22 feet. Around the piles, 10-ft deep concrete mats were constructed and these in turn interconnected by cast-in-place concrete ties.

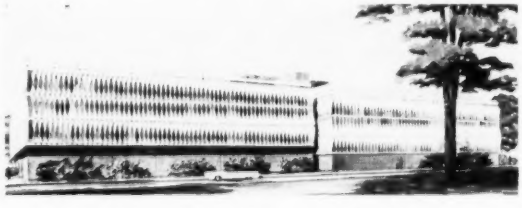
All concrete work was carried out under strict supervision. Aggregates and materials were first tested at the contractor's research department, after which the mix was designed in accordance with the specifications.

The plant's power station also rests on cast-in-place pile foundations, with columns of this building supported by pile caps. Ground floor concrete slabs are carried from concrete beams connected between pile caps.

Modernistic Parking Garage

Construction is under way for a 5-story, 870-car parking garage for the staff of the Henry Ford Hospital in Detroit. The modernistic structure features an open-deck split level arrangement of floors, connected with short ramps and bridged at half levels.

The sculptured grille enclosing upper levels will screen from view the vehicular activity and presents an attractive pattern necessary for its compatibility with the residential characteristics of the neighborhood. The screen has nearly 2000 hyperbolic parabaloid-shaped precast concrete panels.



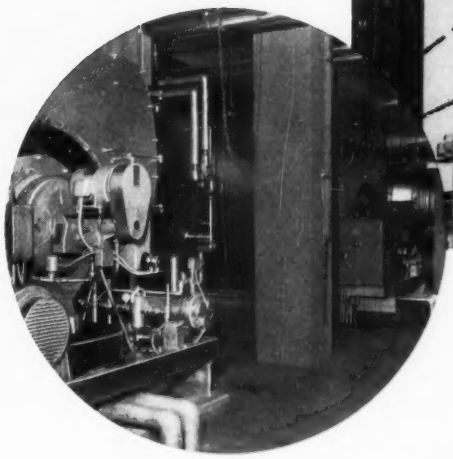
New parking garage for Henry Ford hospital, designed by Albert Kahn Associated Architects and Engineers, Inc.

The building's designers, Albert Kahn Associated Architects and Engineers, have introduced natural light into the center of the structure by separating the two sets of floor slabs and placing an 8-ft wide skylight across the opening.

Finnish Power Expansion

Finland, only now undergoing her industrial revolution, is in the throes of a power facility expansion unprecedented in her history. With power urgently needed for Finland's rapidly growing industry, four hydroelectric and nine steam plants went on

Where the *steam* comes from



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Complete firing system in one package. Every factor that affects firing efficiency is engineered into the unit at the factory. The unit includes: (1) Single or dual-fuel burner, with complete fuel handling systems. (2) Forced draft air supply. (3) Enclosed control panel, with instruments mounted, factory wired and tested, and with signal lights and gauges that afford a complete reading at a glance. In the oil-gas units, fuels can be switched automatically, or with the simple flick of a switch.

Fire low cost residual oils

The heavy residual fuel oils (No. 5 and 6) have higher heat value than light heating oils, yet cost less per gallon.

The Iron Fireman boiler-burner units shown here fire these sluggish oils with complete dependability. They protect against fuel emergencies because they can fire *any* grade of oil, light or heavy.

Gas or oil—switch fuels instantly

Dual-fuel models fire either gas or oil, and can be switched either by manual or automatic controls. In some areas gas rates are substantially less for customers whose steam plants switch automatically from gas to oil firing when outdoor temperature falls below a certain level, relieving the load on main gas lines when demand is highest.

Fires all types of boilers

Iron Fireman residual oil firing (with or without gas) is available in complete boiler-burner units ready for service connections, or as a package firing system that can be applied to any type of boiler.

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AUTOMATIC FIRING EQUIPMENT

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Please send information on Iron Fireman forced draft firing for oil, gas or oil-gas combination.

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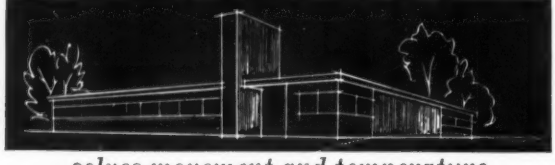
NEW HORNFLEX SEALANT



solves movement and temperature problems in curtain wall joints

Movement due to winds and temperature extremes pose a trying problem for designers of curtain wall buildings. The joint material must seal out water, dust and air but must remain flexible and resilient under these conditions. Hornflex, a thiokol formulation, provides a squeeze-stretch range of 325% and stays firm and elastic over a temperature range from *50° F BELOW ZERO to 250° F.*

Other uses for Hornflex are to fill and seal surface joints in bridges, highways, swimming pools, etc. Laboratory test and job applications indicate that Hornflex, properly installed, will provide excellent protection for periods up to *25 years and more.*

Like complete details? Write for Hornflex Technical Bulletin to Dept. H51-1229.

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the line in 1958, boosting production by 200-million kwh. Under construction are hydro and steam plants with a total capacity of 625,000 kw.

Of the hydroelectric plants just completed, the unit at Kaltimo with a capacity of 38,000 kw is the largest. But there is a trend to larger and more efficient hydro stations. Pirttikowski station will have a capacity of 130,000 kw and the plant at Valajaskoski a capacity of 50,000 kw.

Award-Winning Educational TV System

Fred S. Dubin Associates, Consulting Engineers of Hartford, Connecticut, did the mechanical and electrical engineering on the senior high school in Concord, Massachusetts that was given an award by The American Association of School Administrators for its "unusual educational television system." George J. Giannoni, an Associate of the firm, designed the system that has stirred nationwide interest among educators.

Spanish Pulp Mill

Stadler Hurter International Ltd., Consulting Engineers of Montreal, Canada, will work with SERETE, Ingenieurs Conseils of Paris, in the planning and design of a chemical pulp mill for Empresa Nacional de Celulosas de Huelva, Madrid. The mill will be located in southern Spain near Huelva, the port from which Columbus sailed for the new world.

The mill will produce 100 metric tons per day of dissolving pulp as well as unbleached and bleached grade pulps, using Eucalyptus Globulus and Eucalyptus Rostrata as raw materials. Stadler Hurter is conducting laboratory and pilot plant pulping tests in Canada to determine the optimum process, and will design all pulp mill phases of the project.

A gravity dam is now under construction on the Rio Meca river to supply process water for the mill. SERETE will design the steam plant, mill services, and all civil works.

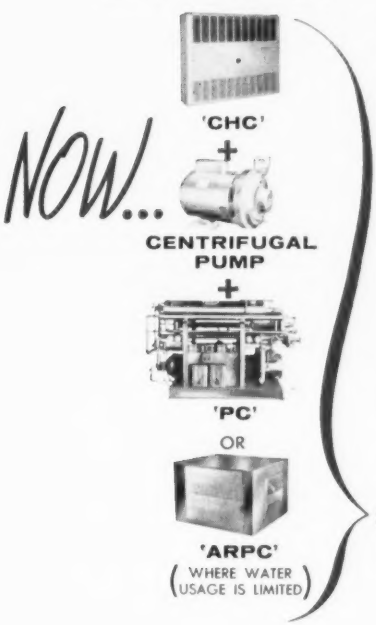
Standard Plans and Specifications for Schools

California's Citizens Commission on Public Schools is studying the controversial question of why the state's new schools cannot be constructed from standard plans and specifications to avoid repetitive engineer and architect fees. Commission Chairman Fordyce V. Cowing has pointed out that since the War, California has spent about $2000 million for new schools, representing some $160 million in engineer-architect fees.

Commission members favoring stock plans point to successful mass production of residential housing and industrial construction and the fact that there are common terrain problems throughout the

NEW DUNHAM-BUSH 'CHC'

COOLING HEATING CONDITIONER



Where there's a need, there's a Dunham-Bush product!

The new "CHC" Cooling-Heating Conditioner continues the Dunham-Bush pattern of product progress providing "one-source-one responsibility" for all your air conditioning, heating, refrigeration and heat transfer needs.

"CHC" is a compact fan coil unit for mounting between-the-studs of a wall structure, designed to meet the smaller space and capacity requirements of motels, hotels, apartments and residences. Together with Heat-X Package Water Chillers, Dunham-Bush Pumps, and Water Savers, all the necessary equipment to meet complete specifications are provided.

Dunham-Bush "CHC" units are available in two basic sizes—Model CHC-150 and CHC-300. The standard unit is basically designed for free standing use readily adaptable for semi-recessed applications. Each standard unit can be wall mounted, fully exposed or semi-recessed, as required for "off the floor" installations. Matching trim pieces are available for finishing purposes on semi-recessed applications.

Other available features include fresh air wall boxes to meet ventilation requirements calling for the introduction of fresh air up to 20% of the rated CFM: rear discharge sections and grilles to permit discharge of up to 50% of the rated CFM to adjacent rooms where the standard unit is installed on a common interior partition.

Keep up-to-date on the latest! Write for complete "CHC" specifications or call your Dunham-Bush sales engineer.

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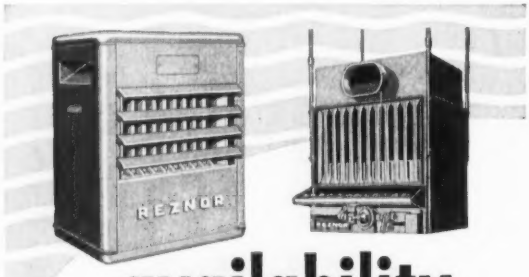

availability

When you specify Reznor gas heaters, you can do so with confidence that the equipment you call for will be available when it's needed, anywhere in the country. Substantial stocks of all the most frequently used models (both unit heaters and duct furnaces) are maintained by Reznor distributors in more than 200 cities. And if the units you call for don't happen to be available from distributor stocks, shipments from the factory can be made to meet any reasonable schedule.

AVAILABILITY is just one of many reasons why Reznor is right for a wide variety of commercial and industrial buildings. Ask your Reznor distributor for details or write for your free copy of "Modern Heating".

Look for Reznor under "Heaters-Unit" in the Yellow Pages

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WORLD'S LARGEST-SELLING DIRECT-FIRED
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state. California's three major weather areas – dry, wet, and mild – also are not considered to be insurmountable obstacles in the development of statewide standard plans and specifications by those favoring the change in policy.

Opponents of the stock plans say that states which once advocated this type of planning have discarded it as uneconomical in the long run. Standardized plans also are not feasible because there are numerous individual factors that govern the design of a particular school at a given location – soil, weather, and terrain being largely variable.

Thin, Square Fluorescent Lamps

Both Westinghouse and General Electric have produced experimental fluorescent lamps that resemble large thin glass tiles and give good light output and efficiency. This new shape provides an area source of illumination, offering advantages over the incandescent's point source and the conventional fluorescent tube's line source. They can be made of heavy, shock-resistant glass and used in flush installations on roadways and runways.

The thin design shows promise of reducing building costs since less space will be needed in ceilings and walls for mounting lighting equipment. Another advantage claimed for the new design is reduced maintenance cost. In present fluorescent lighting fixtures, it is necessary to clean the tubes, the reflector, and the diffusing element of the fixture. These new lamps incorporate all three of these elements, and it will be necessary to clean only the outer glass surface.

These new lamps are not yet in production. Both companies are working closely with lighting engineers and architects to determine optimum sizes and styles.

Lubrication-Free Bearings

A bearing has been developed in the United Kingdom for use where oil lubrication is either impossible or undesirable. These "Polyslip" bearings consist of a porous sintered bronze matrix impregnated with PTFE (polytetrafluoroethylene). A layer 0.0005-in. thick of PTFE also is formed on the surface of the bearing. During the initial run-in period, this film of PTFE is transferred to the bearing surface of the journal, and there is no contact between metal surfaces.

If there is a breakdown of this solid film, bearing temperature rises causing the PTFE in the sintered bronze pores to expand, thereby reforming the lubricant film and reducing bearing temperatures. The life of these bearings are increased by the presence of liquids, in which the bearings may be partly or wholly immersed, and by the use of certain additives with the PTFE film. ▲▲

Cut Fire Hazard

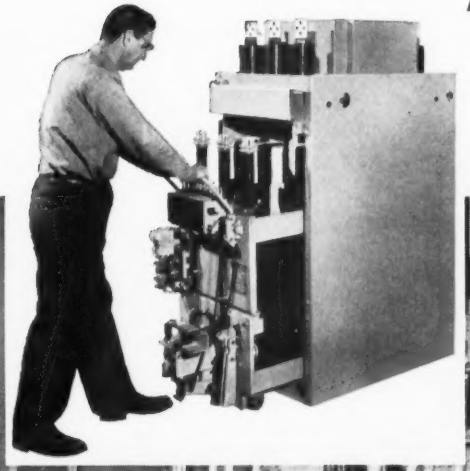
Replace obsolete under-capacity breakers with low cost, high speed 4.16-kv oilless units

In plant after plant, it's possible to eliminate a fire hazard . . . reduce maintenance . . . provide modern high speed interruption . . . plus adequate interrupting and continuous-current capacity with Allis-Chalmers replacement breakers.

Existing cables and structures can be used with these replacement breakers. Low cost modernization can thus be provided in power-generating and substation facilities. The air magnetic breaker, together with its sturdy metal enclosure, can be installed in the masonry cell or open-type iron pipe framework previously occupied by the obsolete oil circuit breaker. Buswork, disconnect switches, current transformers, and cables can all be retained.

Modern features of breaker include: 5-cycle interruption, flame-retardent insulation, safety interlocks, full steel floor in breaker compartment, automatic shutters, one man disassembly. Interrupting capacities from 75,000 to 250,000 kva available.

For details contact your nearby A-C man or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



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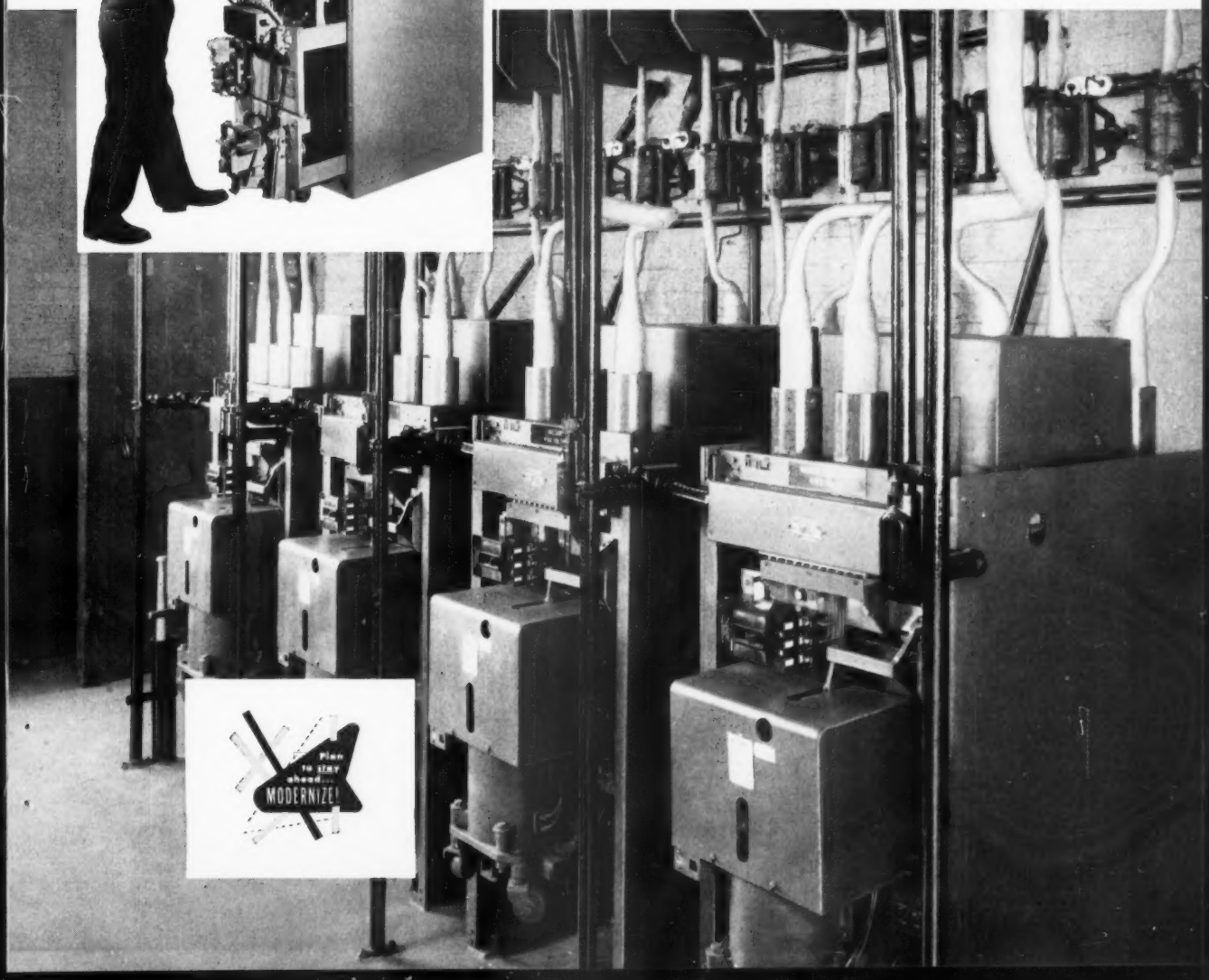
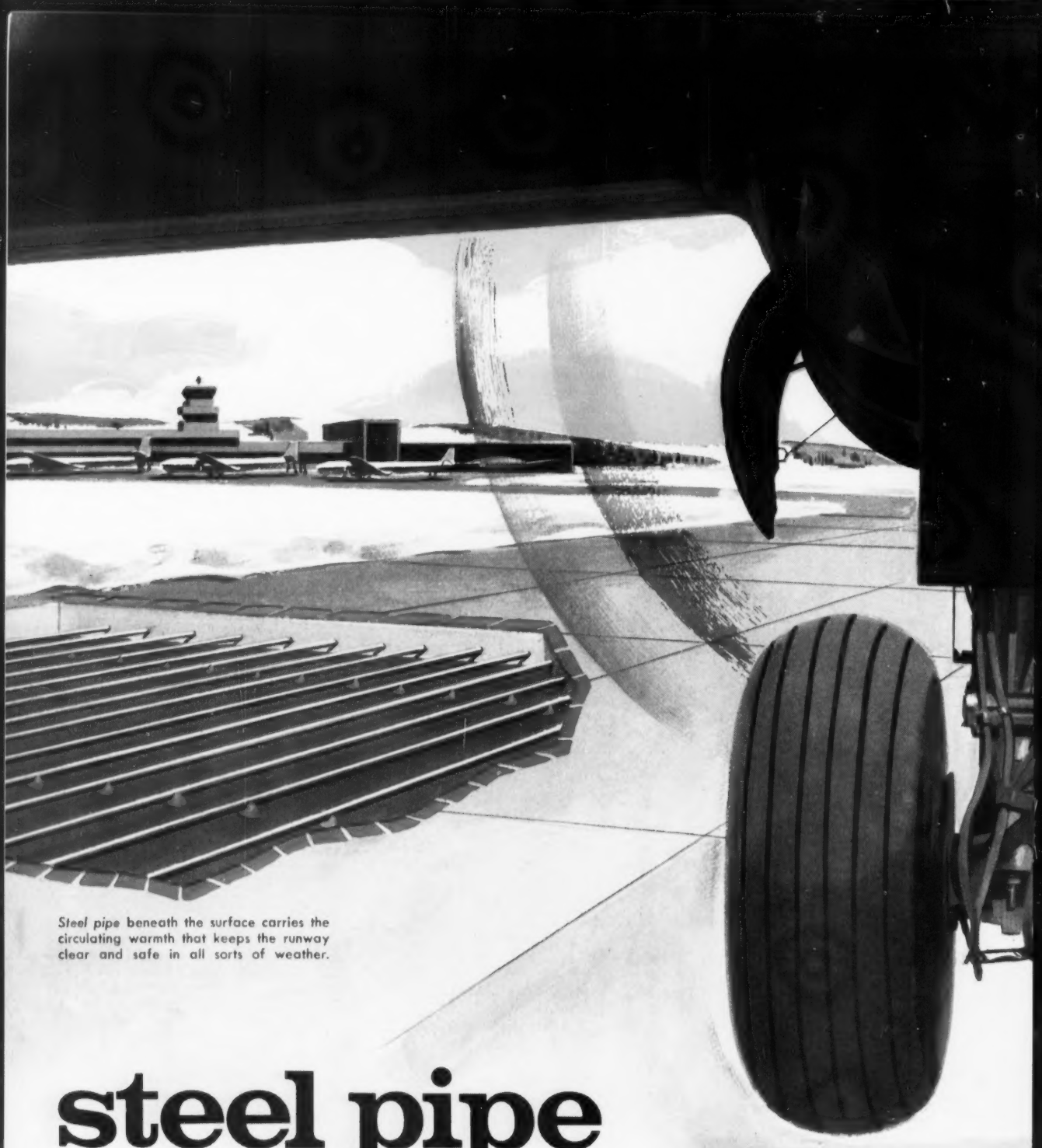


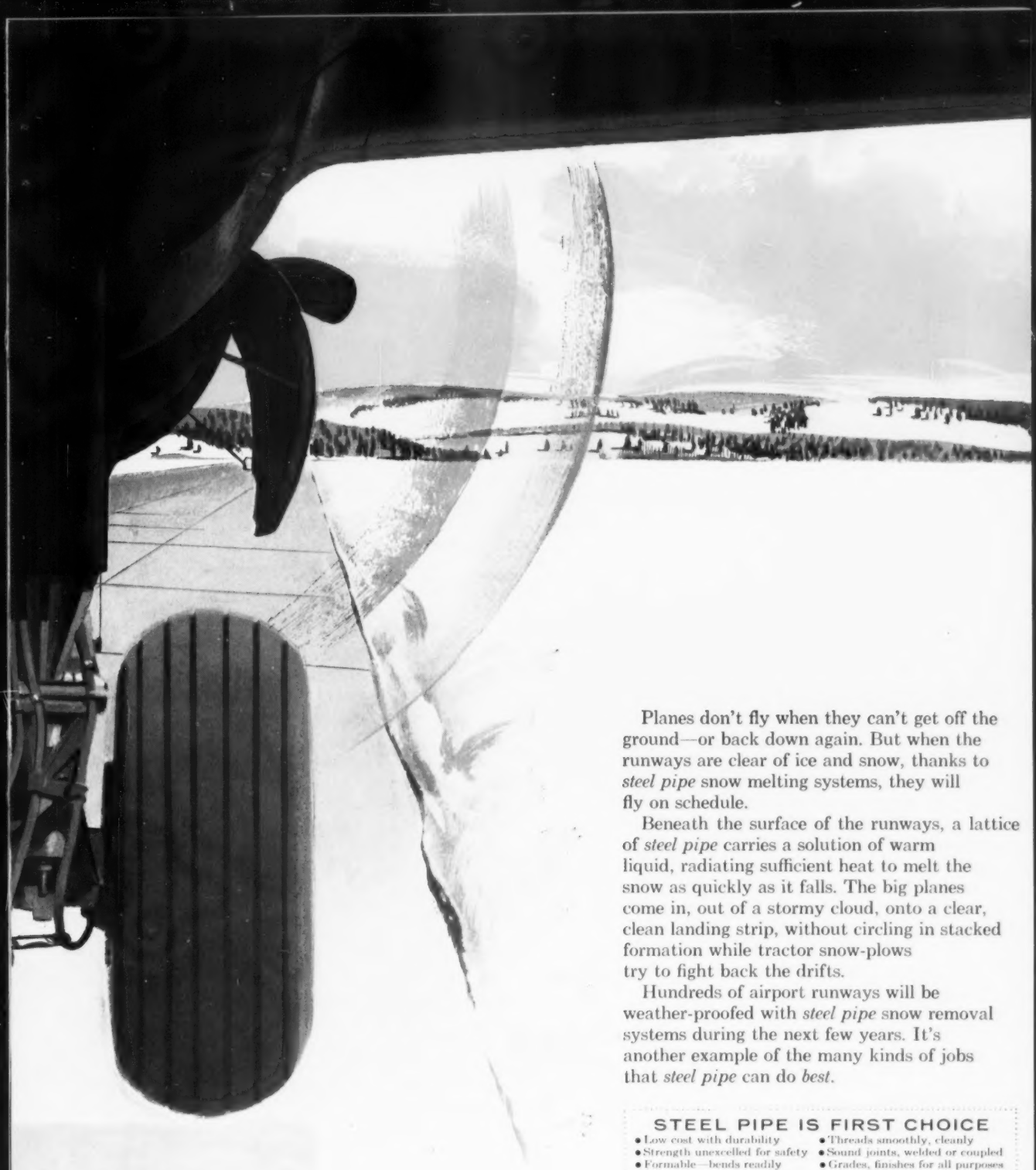


Steel pipe beneath the surface carries the circulating warmth that keeps the runway clear and safe in all sorts of weather.

steel pipe

snow melting systems

keep runways clear



Planes don't fly when they can't get off the ground—or back down again. But when the runways are clear of ice and snow, thanks to *steel pipe* snow melting systems, they will fly on schedule.

Beneath the surface of the runways, a lattice of *steel pipe* carries a solution of warm liquid, radiating sufficient heat to melt the snow as quickly as it falls. The big planes come in, out of a stormy cloud, onto a clear, clean landing strip, without circling in stacked formation while tractor snow-plows try to fight back the drifts.

Hundreds of airport runways will be weather-proofed with *steel pipe* snow removal systems during the next few years. It's another example of the many kinds of jobs that *steel pipe* can do *best*.

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
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Books

Parallel Reading for Consulting Engineers

A History of Technology by Friedrick Klemm is an outstanding contribution in a fascinating field, and the translation by Dorothea Waley Singer is well worth reading.

Writers of the history of technology quite frequently strive to place this subject in a general historical environment by relating it to culture, science, politics, and human psychology. Unfortunately this effort only infrequently has born fruit — it is a most difficult challenge. The efforts to give "the broad view" sometimes have been little more than a placing of "facts" from political, cultural, and other history alongside those from the history of technology and then hoping that a "relationship" has been established because the "facts" occurred simultaneously.

Friedrich Klemm, librarian of Munich's great German Museum for the history of technology, by contrast, has compiled and written a history, of technology that weaves the thread of technological development into the broad fabric of history. The success of his venture will be fully appreciated by those who are familiar with the earlier literature in this field. It may be that Klemm has succeeded because he has not attempted too much when the writing of the history of technology is yet a "new" field; he has not written a narrative history of western technology but has skillfully related — by highly intelligent, informed, and readable commentaries — a number of well chosen and pertinent selections from various historical sources.

In his longer introductions to the various historical periods and in the shorter introductions to the readings selected for these periods, Klemm shows his familiarity with general history and with the history of technology. He strives to demonstrate the lively interplay between the varied kinds of history-making forces (including the free will of the individual) and technology by choosing readings from philosophers, churchmen, politicians, manufacturers, scientists, engineers, and others. These readings and Klemm's commentaries have been skillfully related, and he has convincingly developed several major themes for each of the periods with which he has dealt.

In his introduction to the readings he has selected for the Graeco-Roman period, Klemm emphasizes the impact of commonly held value-judgments on technological progress. He reminds us that Plutarch wrote of Archimedes, "he possesses such a lofty spirit, so profound a soul, and such a wealth of scientific theory, that although his inventions had won for him a name and fame for superhuman sagacity, he would not consent to leave behind him any treatise on this subject, but regarding the work of an engineer and every art that ministers to the needs of life as ignoble and vulgar, he devoted his earnest effort only to those studies the subtlety and charm of which

a new structural bolt

The "A 325" and three radial marks on the head guarantee that this bolt is made of high carbon steel, and meets or exceeds rigid ASTM A 325 specification. The "L" identifies it as a genuine Lamson & Sessions bolt.

This nut is used with both the Lamson High Strength Bolt and the Lamson High Strength Bearing Bolt. The three long indented arcs on the ends of the nut indicate that it meets or exceeds ASTM A 325 specification. The short dashes between the arcs identify it as a genuine Lamson nut.

LAMSON HIGH STRENGTH BEARING BOLT*

Combines the tensile strength of a hex head high strength bolt with the bearing of a rivet.

Has the highest shear strength and greatest resistance to slip of all structural bolts.

This new high strength bearing bolt — developed and manufactured by Lamson — offers design, erection and structural advantages over both the hex head high strength structural bolt and the Dardelet Rivet bolt.

Size for size, this new bolt costs the same as the other two,† yet provides a more rigid structure at less cost. Field tests have proved its superiority beyond doubt, and already many structures have been erected using this bolt.

The new Lamson High Strength Bearing Bolt is available now through 20 U. S. Steel Supply Division Steel Service Centers in key locations throughout the country.

Write Lamson & Sessions for Bulletin HSBB. Contains pertinent engineering data. Firm names, and locations where these new bolts have been used will be mailed promptly on request.

**Pat. App. for*
†Cost based on using nuts and washers as recommended.

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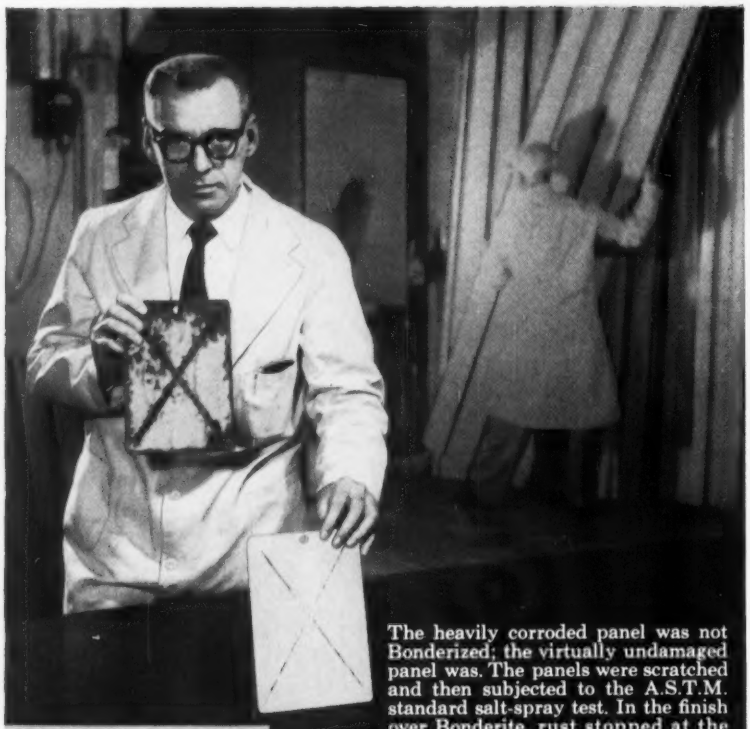
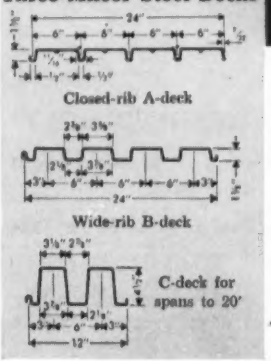
Plants in Cleveland and Kent, Ohio • Chicago and Birmingham



The heavily corroded panel was not Bonderized; the virtually undamaged panel was. The panels were scratched and then subjected to the A.S.T.M. standard salt-spray test. In the finish over Bonderite, rust stopped at the scratch-mark — but it spread extensively over the other panel.

Three Milcor Steel Decks



Milcor high-strength B deck safely carries normal loads over spans up to 10'. Wide rib-openings help to make welding from above easier and faster.

Continuous 8-day salt-spray test proves prime advantage of Milcor Steel Roof Deck

Field painting costs cut in half with Milcor Bonderized Deck!

Prime paint that withstands salt spray for 192 hours certainly can take the wear and tear of shipping, storage, and erection. This often damages ordinary factory-applied primer.

Milcor deck is Bonderized, fortified against corrosion. Then it is flow-coated with an epoxy-resin enamel, oven-baked to abrasion-resistant hardness. One field coat of paint on Milcor deck usually does the job of two coats on ordinary decks.

See Sweet's, section 2f/InL — or write today for catalog 240.

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Steel Roof Deck

RD-22

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are not affected by the claims of necessity." Little wonder that the Greeks did not strive for "better things for better living through . . ." technology.

While Klemm's major argument is that technology held a subordinate position in this period he does not fail to illuminate other facets of the environment that affected the character of technology. By way of illustration, Klemm notes that the needs of religious ritual for the wondrous dictated Hero of Alexander's invention of intricate machinery for mysteriously opening temple doors and kindling alter fires; and that the need of the state produced a relatively high type technology of artillery-making.

Among his readings for the Graeco-Roman period, Klemm includes a selection that will certainly interest those engineers who feel as if the "profession" today suffers from lack of breadth. Vitruvius advised the Roman architect-engineer in his work *On Architecture* (around 25 B.C.), "he should be a man of letters, a skillful draughtsman, expert in geometry, not ignorant of optics, well grounded in arithmetic; he should know considerable history, have listened to the philosophers diligently, should be acquainted with music; he should not be ignorant of medicine, he should be learned in the findings of the legal experts, and should be familiar with astrology and the laws of astronomy." (Perhaps the 20th century engineer will question the wisdom of including astrology in the engineering-school curriculum — but fashions change.)

Klemm's general introduction to the Middle Ages may well be his outstanding contribution. In a few pages he has summarized the variety of ideological factors influencing technological development. Not too many years ago it was common to discount the Middle Ages (dark ages?) when tracing the evolution of "know-how." Now there is a "revisionist" school of historians (among them is the American

LATEST IN COOLING Gas operated York machines feature the use of tap water as refrigerant and lithium bromide as absorbent, one of the most efficient, practical refrigeration cycles developed so far. Machines start and stop automatically.

"with **YORK GAS** *air conditioning our boilers keep us cool all summer"*

"With our boilers sized for a winter load, we were naturally oversized for the summer months. But York's gas-operated Lithium Bromide absorption water chillers permit us to make efficient use of part of this steam capacity to cool," says Mr. M. J. Mather, President of the Allen Manufacturing Company, makers of hex-socket screws.

The York Lithium Bromide system eliminates the need for huge compressors found in other types of cooling equipment . . . which brings down the original cost considerably. And with gas as the boiler fuel, you make year-round use of an otherwise wasted source of power *at rock bottom costs.* In addition, York machines are noiseless, lightweight, compact – easy to install and readily adaptable to almost any plant layout.

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historian Lynn White) who have demonstrated the technological legacy of the Middle Ages.

Klemm associates himself with this interpretation as he emphasizes the impact of Christian morality and philosophy on technology. Klemm writes, "by means of a series of discoveries, and not least by the Christian teaching that men are created free by Nature, and are all equal before Christ, the Christian Middle Ages succeeded in building a civilization which no longer, like that of antiquity, rested on the backs of slaves, but to a greater and greater extent derived power from machinery."

The selections of readings for the Middle Ages convincingly support the argument that Christianity stimulated man to impose his will upon the "things" of this world, as a means to the end of perfecting the spirit. In the first half of the 12th century a churchman, quoted by Klemm, wrote "it is precisely in order than Man may be given full opportunities to make his own discoveries that he is left to discover by his own reason . . . those glorious arts . . . of painting, weaving, sculpture, foundry, and countless other arts . . ." The churchman wrote further, "the goal and object of all human activity and effort . . . should be directed either to recovery of the primal purity of our Nature, or to assuagement of those evils to which our life today is necessarily subject . . ." These medieval sentiments are closely akin to those of the 20th century humanist who foresees the elevation of human spirit through the mastery of the material world.

The selections are by no means altogether serious or learned. Klemm has varied his presentation well, including such human interest documents as the somewhat vain — but not irreverent — self-composed epitaph of the wandering medieval engineer, Konrad Kyeser ("there perished in a strange land Konrad Kyeser of Eichstaett, a man friendly, open-handed, gentle, sociable in his dealings; . . . eloquent too"). Equally remarkable is Villard de Honnecourt's professed reason for writing his "sketch-book" (c. 1235): "Villard de Honnecourt greets you, and begs that all those who work with the help given in this book will pray for his soul and will keep him in memory." — It is unlikely that the editor will express himself similarly in the next issue of CONSULTING ENGINEER.

Perhaps the reader will find some of the selections for the Renaissance somewhat less stimulating than those in the medieval section. This depends upon his interest in detailed descriptions of technological processes: a 16th century brass foundry, for example. On the other hand, the material is spiced by a selection from Leonardo da Vinci in which he casually mentions his ability to paint and sculpture ("I can carry out sculp-

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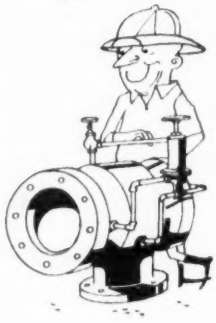

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ture in marble, bronze, or clay, and also I can do in painting whatever may be done") while he emphasizes his skill as a military engineer ("I have a sort of extremely light and strong bridges, adapted to be most easily carried, and with them you may pursue, and at any time flee from the enemy").

In the selections for the Baroque period (late 17th and early 18th century) Dr. Klemm has included some highly interesting and uncommon documents. In one excerpt a British advocate pleads for a remarkably sensible concept of patent protection as early as 1602 (Klemm believes that a sound patent law contributed measurably to the development of technology in Britain), and there is a description by the 17th century scientist Huygens of his gunpowder engine and the manifold applications envisaged for this prototype of an internal combustion engine. Through his selection of related documents for this period, Klemm has effectively reminded us how Huygens' assistant Papin evolved the steam engine (atmospheric) out of his master's gunpowder engine. As is the case with many other selections, the text on Huygens' engine is enlightened by contemporary illustration.

The section on the "Age of Rationalism" makes clear the importance of the French spirit of rationalism during the 18th century for the history of technology. Encouraged by the monarchy – which was to be overthrown at the end of the century – the Academy of Sciences sponsored a lengthy study of manufacturing processes in France. It was intended that the study, *Descriptions of the Arts and Crafts*, published between 1761 and 1789 would make known and generally useful the best manufacturing techniques. Upon completion of publication the work included 121 parts with over 1000 plates.

Equally impressive was the contribution of the great French *Encyclopedia* compiled by the enlightened critics of absolute monarchy. Klemm notes that the editor of the *Encyclopedia*, Diderot, who wrote many of the articles on technology, never tired of visiting factories and processes. The *Descriptions* contributed substantially to the improvement of French manufactures, and the *Encyclopedia* convinced revolutionary-minded bourgeoisie of the importance of technology.

Again in the introduction to the 19th century (the period of industrialization), Klemm demonstrates his comprehensive concept. He notes the significance of advances in chemical technology for the Industrial Revolution in England; he reminds us that there were many miles of railroad tracks before there were steam engines to pull the cars along them; he gives a brief selection that brings forth the drama and tragedy of a mill riot in Manchester early in the 19th century; he does not ignore the effect of

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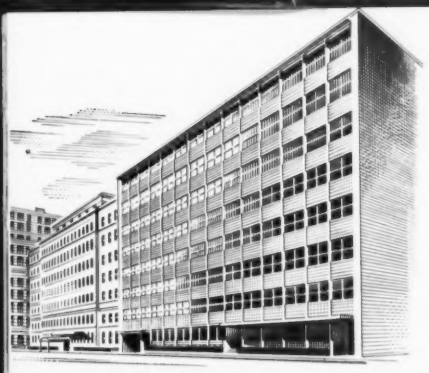

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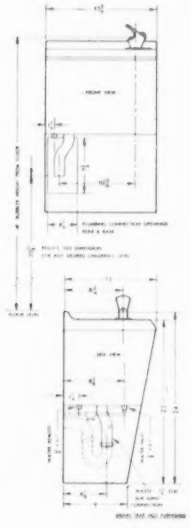
industrialization upon the human psychology (a phase so aptly chosen); and he includes a selection from the 19th century German industrialist, Friedrich Harkort that reveals a contemporary's awareness of the political significance of the advancing railway technology (with a railroad from the Ruhr region to Bremen-Hamburg the Germans could avoid payment of the Rhine tribute that was exacted by the Dutch).

While the importance of the age of the Industrial Revolution for the present day cannot be denied, it is interesting to note that Dr. Klemm only gives about 50 of his nearly 400 pages to this period; a marked contrast to many general histories of technology which give a third or a half of the available space to the period since 1800. More than likely Klemm's emphasis upon the earlier periods gives this volume a certain freshness and originality, and the history of technology an infrequently encountered depth.

The final selection on the most recent period is stronger when dealing with the rise of American technology in the late 19th century than when treating the 20th century. Using the eyewitness accounts of European travelers to America, Klemm provides a vivid impression of the impact that the burgeoning New World technology made upon technically informed visitors from the Old. On the other hand, the selections on 20th century technology appear to give undue emphasis to the German scene (Lilenthal writes about flying; Ferdinand Braun about radio; and C. Bosch about the progress of chemical technology). This criticism, however, might stem from American chauvinism, and it is only fair to note that a long excerpt from the official American report on the first atom explosion is included.

The translation by noted British historian of science Dorothea Waley Singer of the German edition (which appeared in 1954) is praiseworthy. Klemm's style is sophisticated, and 25 centuries of technical terminology are formidable. There are very few translation errors: Singer gives the impression on page 325 that the American states were only united after the Civil War – Klemm wrote that the states "zusammengekaempft" (fought together); and Singer translates on page 335 that the machine was "the sole element in North American life" while Klemm wrote that the machine was an "eigentliche Lebenselement" (intrinsic element in life). While not a translation error, the reader should note that the phrase General Electric Co. on page 353 should not be taken as the American company which had not been founded at the time but is a translation of *Allgemeine Elektricitaets-Gesellschaft* (the German firm).

This excellent translation of a splendid contribution to the history of technology when taken all



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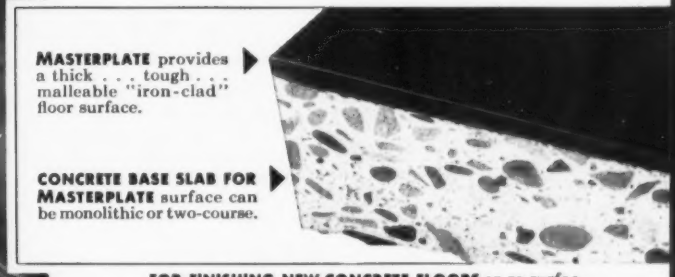
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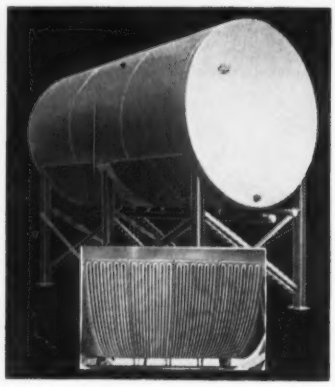

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For The Office

SIMPLIFIED PROBLEMS IN STRENGTH OF MATERIALS AND STRUCTURAL DESIGN, by Ephraim Viertels; Arco Publishing Company, N.Y.; $5.00. This text, in problem-and-answer form, provides a practical and comprehensive review of the basic principles of structural engineering. Either as a reference work or as an aid to the solution of everyday problems, it belongs in the consulting engineer's library.

AIR POLLUTION CONTROL, by W. L. Faith; John Wiley & Sons, Inc., N.Y.; $8.50. This effectively illustrated new book discusses the air pollution problem in language not directed at the specialist. It is instead directed at those who want an understanding of the over-all problem, and the best means of dealing with it. Some of the newer aspects of air pollution — automobile exhaust and radioactive fallout — also are covered.

ELEMENTS OF PHYSICAL METALLURGY, by Albert G. Guy; Addison-Wesley Publishing Company, Inc., Reading, Mass.; $9.50. This highly technical book is for the engineer with a major interest in metallurgy, covering in detail the fundamental principles of this science. A valuable Appendix is included on the literature of metallurgy discussing usefulness of various texts, handbooks, nomographs, patents, journals, and manufacturers' literature.

BUILDING CONSTRUCTION ESTIMATING, by George H. Cooper; McGraw-Hill Book Company, Inc., N.Y.; $7.50. The second edition of this popular quick-reading text covers in detail all phases of contracting and is of considerable value to the consulting engineer. The mechanical trades section now includes separate chapters on plumbing, heating, and air conditioning. Many good illustrations amplify the text.

ELECTRONIC CIRCUIT THEORY: DEVICES, MODELS, CIRCUITS, by Henry J. Zimmermann and Samuel J. Mason; John Wiley & Sons, Inc., N.Y.; $10.75. This book, as its title implies, is for the electrical engineer. It deals with methods of analyses of electronic circuits, with the model concept emphasized. Extensive graphical and geometrical interpretations of analyses are included as an aid.

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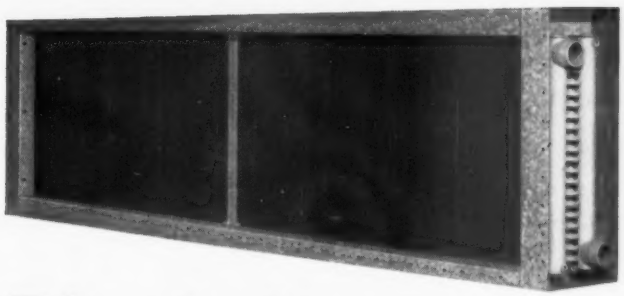

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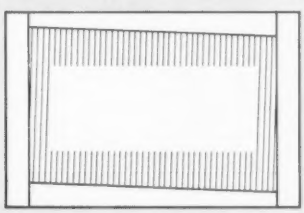

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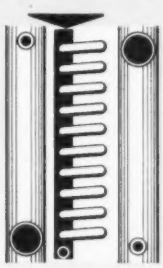

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Edward W. Willard, a member of Austin's research division, has been named to succeed Sayer as manager of plant location surveys, in the Cleveland office.

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M. H. Cutler has been named engineering manager of Stone & Webster Engineering Corporation. Cutler, formerly assistant engineering manager, succeeds Fred W. Argue, who recently was named executive vice president of the firm.

In other executive shifts, Thomas A. Fearnside, chief mechanical engineer, was made assistant engineering manager. Floyd F. Dedrick, formerly assistant chief mechanical engineer, will succeed Fearnside.

Robert L. Jones has been elected executive vice president and a member of the board of directors of Berger Engineering Co., Pittsburgh, Pa. Jones formerly was associated with Koppers Co., Inc.

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Dr. Willard Paul Berggren, Dean, College of Engineering, University of Bridgeport, was named Engineer of the Year by the Connecticut Society of Professional Engineers.

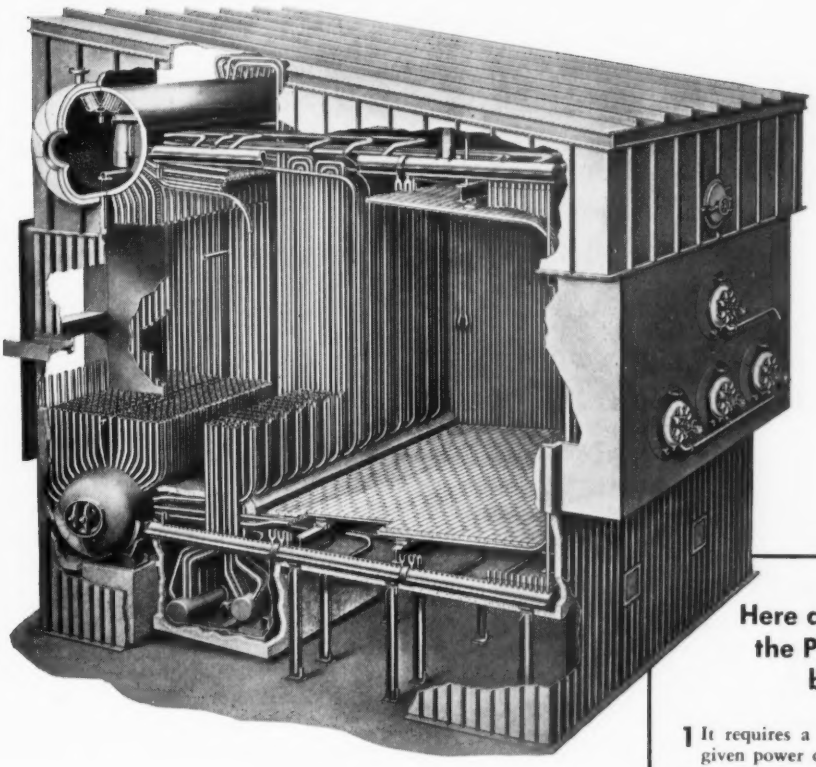
BERGGREN LOWE

Malcolm G. Lowe, chief mechanical engineer for Quinton Engineers, Ltd., of Los Angeles, California, attended the International Conference on Schoolhouse Heating and Air Conditioning held in Paris, France, last month. Lowe also will attend the summer meeting of England's Institute of Heating & Ventilating Engineers in Edinburgh, Scotland. This Institute is the English equivalent of the American Society of Heating, Refrigerating & Air Conditioning Engineers.

Milton C. Coon, Jr. has been named the new executive director of the Building Research Institute. Coon, secretary of the Institute, has been serving as acting executive director.

COON CHELMINSKI

Roman Chelminski has joined Singmaster & Breyer, New York metallurgical and chemical process en-



New B&W PFI Oil-gas burning unit provides maximum output in minimum space

New Economical Power For Industry. This new B&W Integral-Furnace Boiler produces high-quality, dependable steam economically at all ratings. Aptly named the PFI, this "Power For Industry" Boiler is compact, easy to install, quick to meet rapid and wide load swings. It gives long, sustained operation, requires little attention and is readily accessible for inspection, cleaning and maintenance.

Behind *every* B&W Boiler is almost a century of leadership in steam generation. In the past 25 years, over 4,000 B&W Integral-Furnace Boilers have been placed in service. The special skills of B&W engineers, our national network of plants and engineering facilities are at your service. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

Here are 8 ways in which the PFI boiler can be of benefit to you:

1. It requires a minimum amount of space for a given power output.
2. The pressurized furnace design assures economy by eliminating the induced draft fan and air infiltration. This means savings in cost of fans, fuel, and operating power.
3. Pre-assembly of many of the components of the PFI Boiler is controlled in B&W shops, resulting in a reduction of the time and manpower required for field erection.
4. The PFI is designed to burn oil, gas, or a combination of the two. When it is equipped with a dual-fuel burner, it allows you to take advantage of favorable market conditions.
5. Cyclone Steam Separators ensure adequate water circulation which protects boiler tubes from overheating, even with wide and frequent changes in load. They also give you clean, dry steam at all designed ratings with high boiler water concentrations.
6. The drainable superheater design assures quick, safe start-up and ease of storage.
7. Water-Cooled Burner Throat eliminates troublesome maintenance, costly repairs.
8. All-welded Membrane Wall contributes to high efficiency and reduces insulation requirements.

FOR FURTHER INFORMATION ABOUT THE B&W PFI BOILER, WRITE FOR BULLETIN G-94.

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WATER ISN'T CHEAP ENOUGH TO WASTE

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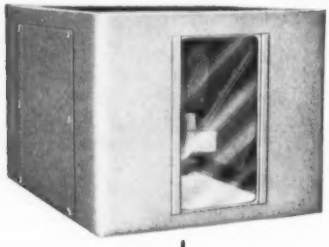
NOW "*Add-To-Design*" PAVES THE WAY TO SIMPLER FEEDER INSTALLATIONS



The W&T Series A-728 Dry Chemical Feeder forms a base for a complete feeder installation. Standard components are available —designed for use with the Feeder. For instance, the A-728 permits

. . . use of hoppers in standard lengths and sizes—ending your hoppering problems.

. . . choice of solution tanks—corrosion resistant and tight for the chemicals you use.

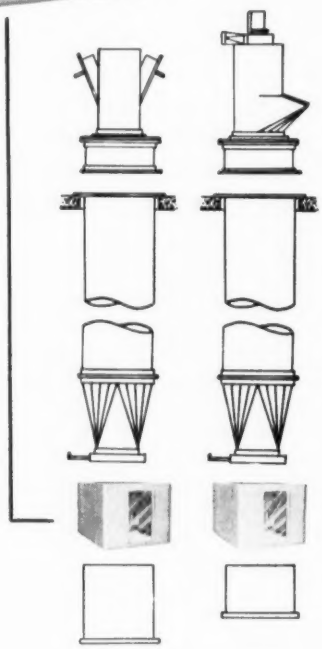
. . . direct feeder mounting of standard dust collectors, bag loaders, screens—eliminating extra structural supports.

. . . use of overhead supports—to eliminate your floor stress problems.

This means you use standard components to build your own custom installation without special design . . . saves you time and money.

■ ■ ■ ■

Write us for information to help you build your own feeder installation—easily and simply. Address Dept. MV-3.25.



WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

gineers, as an associate. He previously was a senior partner of Knowles Associates for 12 years.

An airport planning and financial firm, Leigh Fisher and Associates, of South Bend, Indiana, has become a permanent affiliate of the San Francisco Bay Area firm of Wilsey and Ham Engineers and Planners. Offices of the Fisher firm

HAM FISHER

will be moved adjacent to Wilsey and Ham's Millbrae headquarters in the Millsdale Industrial Park. Plans call for the establishment of combined offices on San Francisco's International Airport property.

New offices of Greeley and Hansen, Engineers, are located at 14 East Jackson Boulevard, Chicago, Ill.

Robert Rosenwasser, Consulting Engineer, has moved his office to 375 Fifth Avenue, New York, N.Y.

Three Subject-Matter Specialists have been appointed to the executive staff of The H. K. Ferguson Company, Cleveland firm of engineers and builders. They are William T. Webster, director, pulp and paper division; Ross A. Langworthy, director, power plant di-

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Design — Design of reinforcing member (trussed and deformed)

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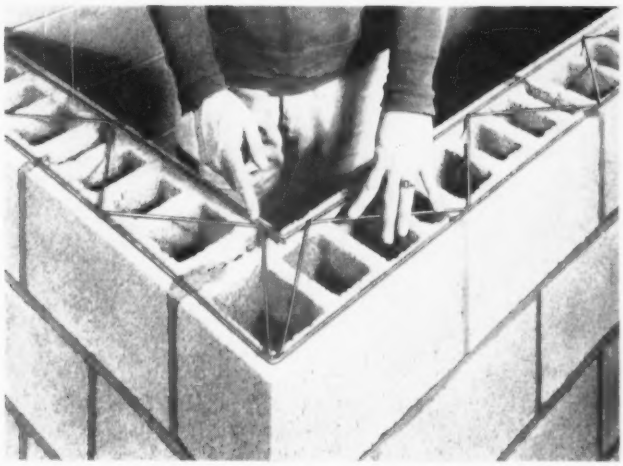

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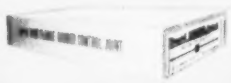

Rapid CONTROL Joint

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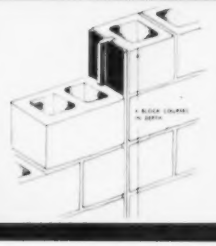
WIDE FLANGE



Neoprene compound flanges with concave edges allow easy compression and tight control joints.

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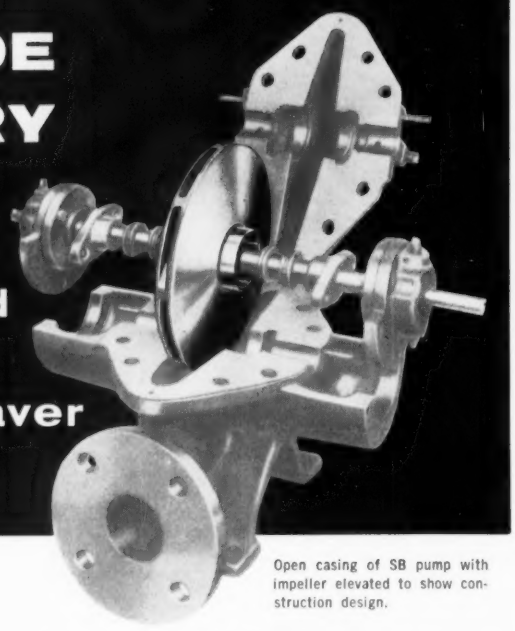
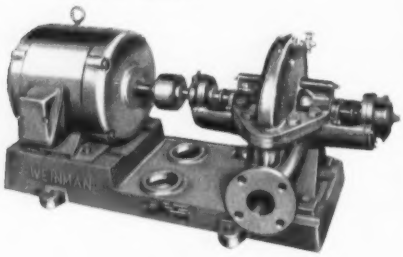
INSIDE STORY of an out-and out cost-saver



Open casing of SB pump with impeller elevated to show construction design.

The heart of a pump is its impeller. Notice in the photo above the clean, efficient design of the double suction bronze impeller for Weinman Type SB pumps. All external surfaces are carefully machined and finished. Interior surfaces are hand finished. Result: More pumping capacity at economical, wear-saving motor speeds.

Weinman Type SB single stage, double suction, split case centrifugal pumps are designed for ½ to 15 hp motors . . . 1800 to 3600 rpm speeds. They handle a lot of different pumping duties. And maintenance costs are down-to-earth. Upper half of the casing is easily removed for inspection. Entire rotating element comes out without disturbing piping, connections, fittings or driver.



Other Weinman pumps feature this same efficient performance. See your Weinman pump specialist about compact, versatile Weinman Unipumps. They're your best answer to a lot of your general service pumping requirements. Mount anywhere . . . horizontally or vertically . . . handle a lot of tough jobs with minimum maintenance.

Type G Unipump. For hot or chilled water circulation, general service pumping.

Write for free Weinman Complete Line Folder. Informative, useful.

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CENTRIFUGAL SPECIALISTS

vision; and John M. Chambers, assistant director, chemical division.

Under the Ferguson Subject-Matter Specialist program, 10 HKF experts have been named to new positions as divisional directors and assistant divisional directors. Within this concept, these men will assume responsibility for the technical excellence of both engineering design and construction of facilities in their particular fields. They are: J. P. Grilli, director, mining and metallurgical division; E. L. Heller, director, nuclear division; T. J. Hodgson, director, laboratory division; A. E. Neu, director, synthetic fibers division; C. E. Baker, director, industrial buildings division; J. E. Flanders, director, chemical division; E. A. Barton, director, traffic engineering division; R. T. DePan, assistant director, pulp and paper division; C. M. Cantrell, assistant director, nuclear division; and A. F. Ventura, assistant director, laboratory division.

CHAMBERS JANEWAY

Cornell Janeway has been named vice president in charge of operations of Janeway Engineering Company, Detroit consulting and development engineers.

At its 111th annual meeting, the Boston Society of Civil Engineers — oldest engineering Society in the United States — elected Edward C. Keane, vice president of Fay, Spofford & Thorndike, as president for the coming year.

Announcement also was made of the following elections: Dr. Arthur T. Ippen and James F. Brittain, vice presidents; Robert W. Moir,

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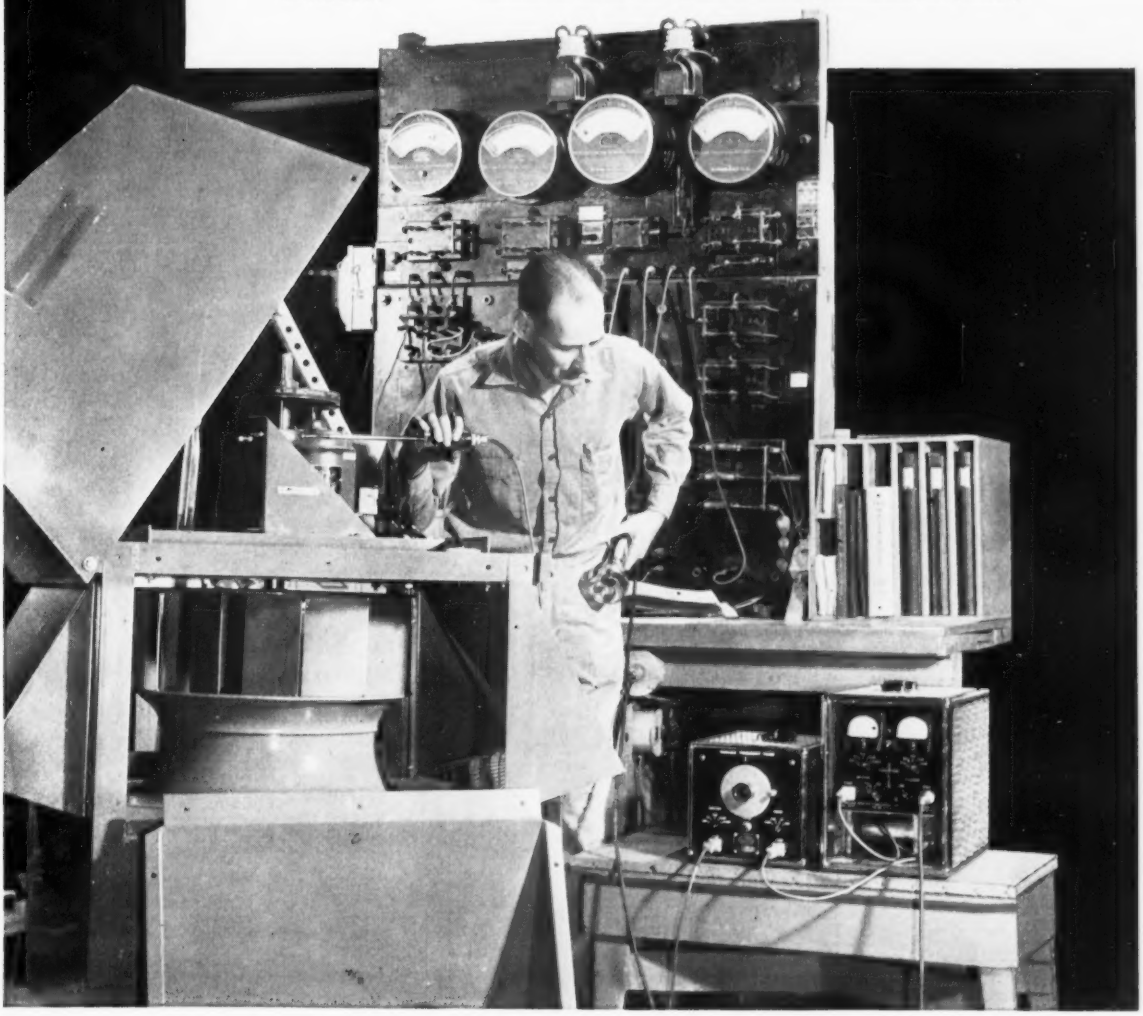

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secretary; and Charles O. Baird, Jr., treasurer. Elected to directorships were J. C. Lawler, C. J. Kray, J. M. Biggs, and F. L. Heaney.

Victor M. Garcia, P.E. has been appointed associate in charge of the San Juan, Puerto Rico office of Fred S. Dubin Associates.

James A. Lang has been named chief of the electrical engineering section of Magney, Setter, Leach, Lindstrom and Erickson, Inc., Minneapolis architects and engineers. Lang formerly headed his own consulting engineering firm, Lang and Cummings, Inc., in Minneapolis.

Vernon Akin has been named an associate of J. Donald Kroeker and Associates, consulting engineers of Portland, Oregon.

Ellis P. Root and Gilbert M. Nelson have joined the staff of Benjamin E. Beavin Company, consulting engineers of Baltimore, Maryland. Previously, both men were associated with consulting firms in Baltimore and were engaged in highway design and related work.

Desso T. Mitchell, formerly sanitary engineer of Franklin County, Ohio, is now with The Jennings-Lawrence Co., civil and municipal engineers, Columbus, Ohio.

Marvin A. Sweet has been named a partner in the firm of W. B. Semco & Associates, Los Angeles industrial engineering consultants, specializing in order and flow systems, plant layout, materials handling, and warehousing.

R. K. A. Jones, Inc. (formerly Jones & Associates) has moved to Highway 140 & St. Dennis Street, Florissant, Missouri.

A new consulting engineering firm, Nelson, Haley, Patterson and Quirk, has been formed, with offices at 911 Sixteenth Street, Greeley, Colorado. Principals of

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is built to last forever
The principle of honeycomb construction is to achieve the greatest ratio of strength to weight.
The creation of Nicolet Asbestos Honeycomb has accomplished this, through great compressive strength (bare core—125 PSI) and light weight (6 oz. to the board foot).
But, more than this—Nicolet Asbestos Honeycomb gives:
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Nicolet Asbestos Honeycomb can be tailored to exact requirements. Find out why you should specify and use Nicolet Asbestos Honeycomb . . . write, wire or phone us today.
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the new firm are LaVern Nelson, John Haley, William Patterson, and Willard Quirk. Previously, all principals were associated with Harold Hoskins and Associates of Lincoln, Nebraska and Greeley, Colorado. The new firm offers professional engineering services in all phases of municipal improvements, highways, and structures.

Chester Schiff, P.E. has moved his consulting engineering offices to new and larger quarters at 150 West 34th Street, New York, N.Y.

Former executive engineers of M B Manufacturing Company have announced the formation of the Unholtz-Dickie Corporation, with offices at 2554 State St., Hamden, Connecticut. Reported to be the first organization dealing solely in professional engineering services on vibration problems, the new firm is set up to provide services on an advisory, training, or task basis, covering the full scope of vibration problems including fatigue, shock and shake testing, designs to withstand dynamic loads, suspension systems, noise control, and equipment and controls associated with dynamic testing.

Officers of the new firm are: John A. Dickie, president; Karl Unholtz, vice president and chief engineering officer; Gerald Reen, secretary; and Donald McCluskey, treasurer.

William H. Byrne, P.E. and associated companies, Byrne Associates, Inc. and Stevens & Wood Incorporated, have moved to new and larger quarters at 50 Church Street, New York, N.Y.

A new consulting engineering firm, Colton, Kool, & Associates, has been formed, with offices at 1276 West Third Street, Cleveland, Ohio. The new firm offers services in all branches of engineering.

A new architect-engineer firm, Rouse, Dubin & Ventura, has been formed, with offices at 55 West 42nd Street, New York, N.Y. Principals are: Marshall J. Rouse, A.I.A.; Milton Dubin, P.E.; and August F. Ventura, R.A.

A new firm, Ian Grad Associates, Consulting Engineers, specializing in mechanical, electrical, and industrial engineering, announces the opening of offices at 114 East 32nd Street, New York, N. Y. Both principals of the firm, Aaron Zicherman and Ian Grad, formerly were with Fred S. Dubin Associates.

Alfred W. Sawyer, partner, Hazen and Sawyer, New York, has been named to the American Standards Association's Standards Council.

Charles R. Greenidge, formerly with Cellarius and Hilmer, has joined A. M. Kinney Associates of Cincinnati and New York, as a project architect. ▲▲

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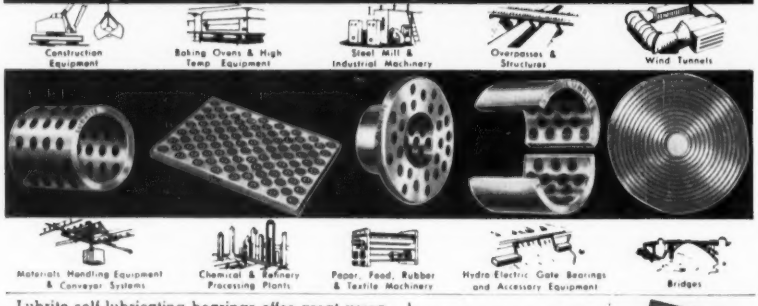
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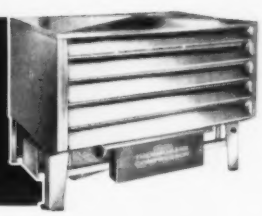

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KRAMER'S outdoor compressor is the *only* compressor designed to operate *outdoors* for *any* application under *all* temperatures and weather conditions.

Completely assembled, wired, tested and factory run-in, it arrives on the job ready to operate. Simple hookup eliminates costly installation and control adjustment time. Kramer's outdoor compressor ends waste of valuable indoor space.

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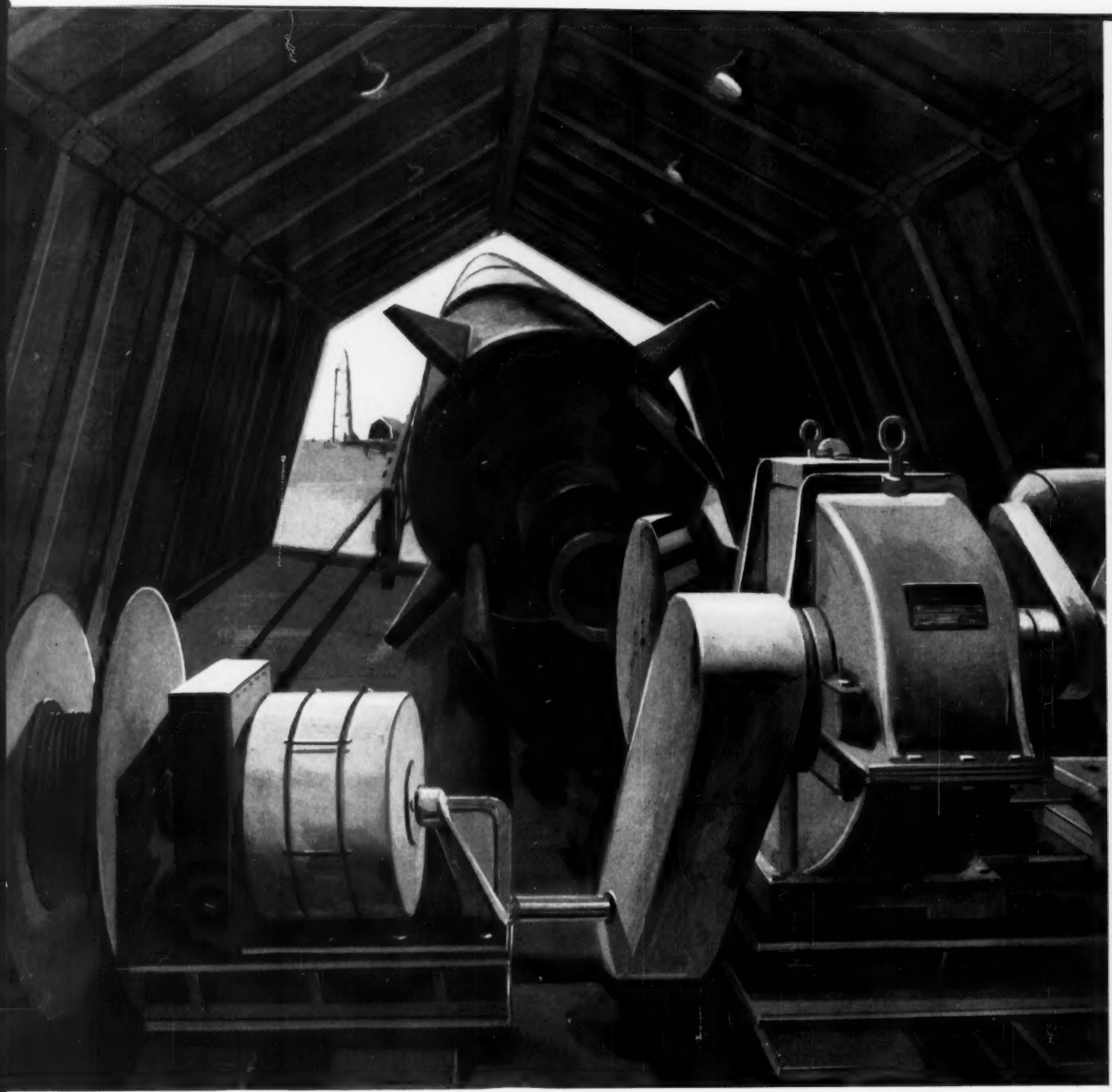


Westinghouse equipment drives

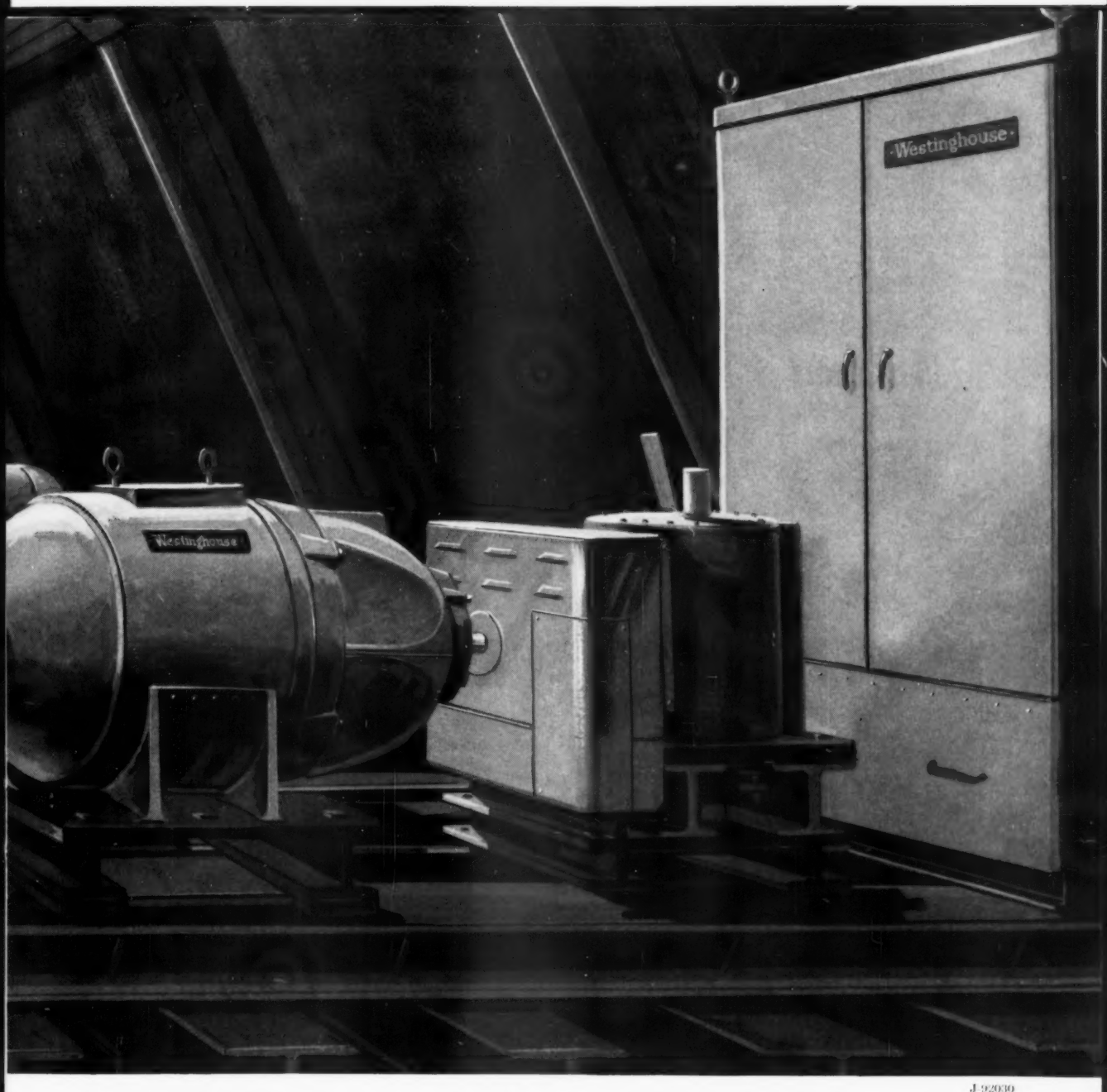
How do you move a 30-ton building at a uniform speed regardless of 60 mile an hour winds that might push with or against it? Westinghouse engineers solved this problem when they designed the automatic shelter drive system for the Douglas/USAF THOR IRBM.

Here is the installation—a fool-proof, self-controlled drive system. The operator pushes the forward or reverse button—the system does the rest, quickly—surely. Westinghouse React-O-Verse control automatically compensates for wind pressures to determine the instantaneous power requirement to move the huge shelter smoothly and uniformly, regardless of wind direction or force.

This is additional proof of the results you obtain when you use Westinghouse range of products, engineering knowledge, single-source responsibility and ability to supply a packaged, guaranteed unit.

Take advantage of these Westinghouse facilities when designing and building retractable shelters, hardened missile sites, erectors, lowering devices or launchers. Contact your local Westinghouse sales engineer or write: Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania.

An illustration of a hardened missile site, suitable for framing, will be sent you if requested on your letterhead.



J-92030

THOR retractable shelters

The Westinghouse equipment includes: 75-hp crane and hoist motor; d-c magnetic brake; double reduction gear and fly-wheel unit; React-O-Verse control; pilot generator; manual and automatic switch and controls; and floodlighting.

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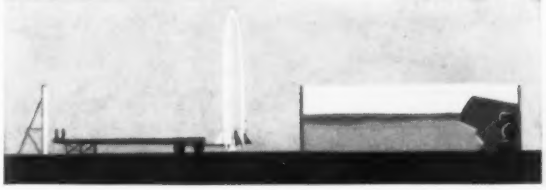
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS



Typical THOR installation, showing a breakaway view of the drive unit in the retractable shelter, missile, free standing end wall of shelter and missile erector.

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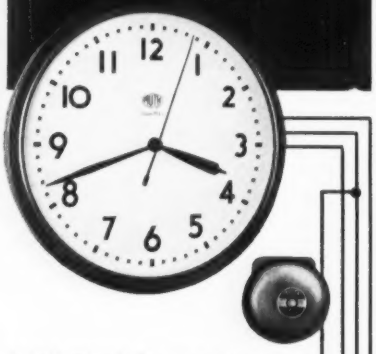
INSTALLATION...
MAINTENANCE...
with Auth
CLOCK and Program SYSTEMS



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New Projects Reported

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ARIZONA

Biddle & Young
Phoenix, Arizona
¶ Eighteen-story office building, Phoenix, Arizona. (mech.) $3.5 million. Client, Charles G. Polacek, architect.
¶ Ten-story office building addition, Phoenix, Arizona. (mech., elec.) $1.5 million. Client, Weaver & Drover, arch.
¶ Eight-story office building addition, Bank of Douglas, Phoenix, Arizona. (mech., elec.) $1.3 million. Client, Charles G. Polacek, architect.
¶ Two thousand-man mess hall and two line maintenance hangars, Marine auxiliary air station, Yuma, Arizona. (mech., elec.) $1,350,000. Client, Charles G. Polacek, architect.

Johannessen & Girand and Earle V. Miller
Phoenix, Arizona
¶ Interstate highway design on 12 miles near Holbrook, Arizona. (highway) $2.4 million. Client, Arizona Highway Dept.

CALIFORNIA

Raymond H. Deddens
Sherman Oaks, California
¶ Henry G. Clements junior high school, Redlands, Calif. (struc., civil) $2 million. Client, Clare H. Day, architect.

John R. Anderson, Structural Engineer
Pasadena, California
¶ Precast concrete tilt-up distribution warehouse, San Bernardino, Calif. 12,000 square feet with wood bowstring trusses, rafters, plywood sheathing, and composition roofing. (civil, struc.) $48,000. Client, United Parcel Service.

Sardis Lacy Waters & Associates
Santa Clara, California
¶ DeLaCruz overpass, Santa Clara, Calif. Grade separation structure and overpass over highway and railroad tracks. (civil, struc., elec.) $2 million. Client, City of Santa Clara, Calif.

COLORADO

Engineering Consultants, Inc.
Denver, Colorado
¶ Remodeling into laboratory space for U.S. Geologic Survey, Denver Federal Center, Denver. (mech., elec.) $317,000. Client, General Services Adminstration.

FLORIDA

Greenlees, Arbogast & Associates
Stuart, Florida
¶ Develop subdivision in Stuart, Florida for L. & R. Builders. (civil) $20,000. Client, Jos. D. Robinson and Andrew Lawler, Miami, Fla.

GEORGIA

Oliver K. Lewis, Jr.
Albany, Georgia
¶ Additions and alterations to Phoebe Putney Memorial Hospital, Albany, Georgia. (mech.) $85,000. Client, Albany-Dougherty County Hospital Authority.

ILLINOIS

Charles N. Debes Associates, Inc.
Rockford, Illinois
¶ Waukegan shopping center, 36,000 sq ft. (civil, struc., mech., elec.) $300,000. Client, Trust.
¶ Lincolnwood shopping center, 250,000 sq ft. (civil, struc., mech., elec.) $3.5 million. Client, Conco Properties.

George J. Chlebicki & Associates
Harvey, Illinois
¶ One-mg prestressed concrete reservoir and pump station. (civil, struc., mech., elec.) $190,000. Client, Village of Posen.
¶ 250,000 gallon steel standpipe and water supply. (civil, struc., mech., elec.)

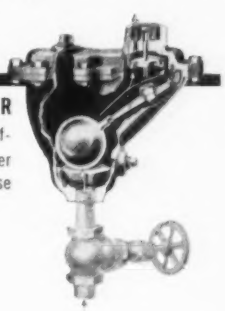
CHECK VALVE SLAMMING

IS LIKE A SERIES OF BODY PUNCHES!

Little by little it "softens up" a pump discharge line for the final knock-out. Moderate slamming causes leakage, throws pipes out of line or causes other damage that may go undiscovered for years. Heavy slamming often causes serious damage and service interruption.

Why risk trouble and service loss? Ludlow and Rensselaer List 340 non-slamming check valves *are non-slamming under the most severe conditions*, thanks to adjustable spring tension. They are recommended as standard equipment wherever slamming is likely to occur.

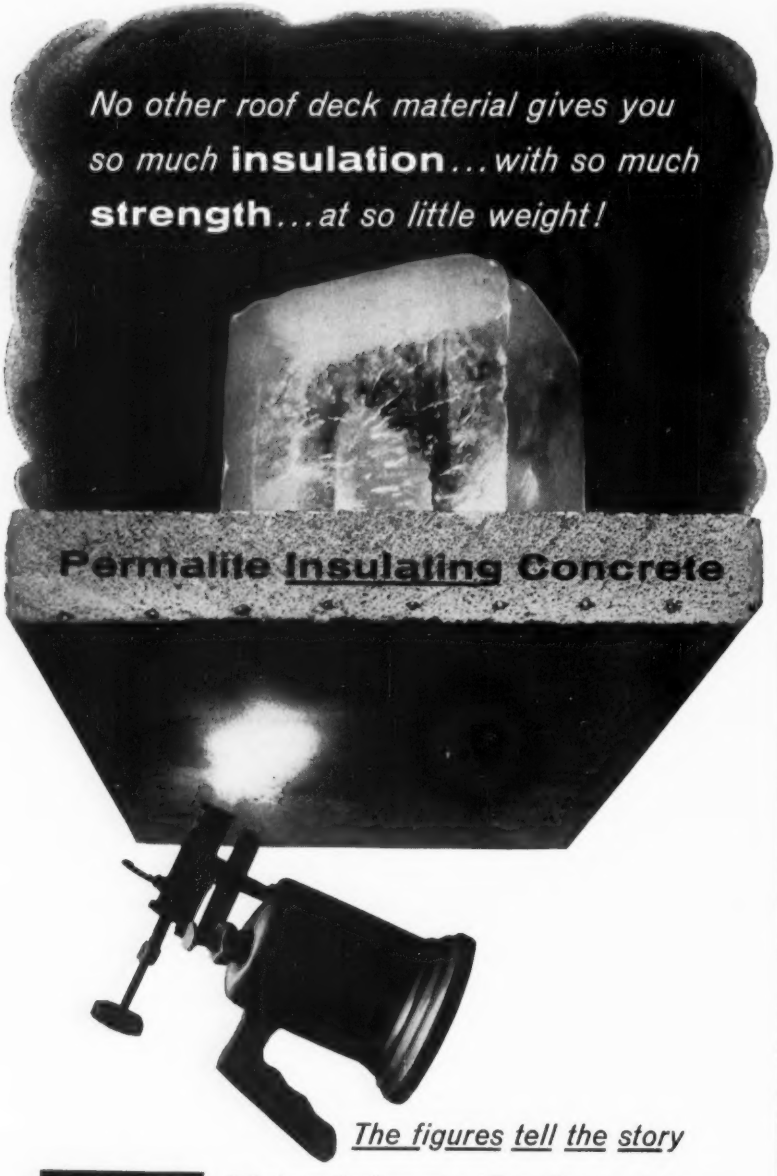
WRITE TODAY for L&R Check Valves Catalog, showing 3" to 30" sizes, with or without lever arm and spring. All materials and workmanship exceed the A.W.W.A. requirements for gate valves and fire hydrants.



POSITIVE CONTROL OF AIR INLET OR DISCHARGE is afforded by Ludlow or Rensselaer air and vacuum and air release valves.

LUDLOW & RENSSELAER
VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N. Y. – SINCE 1861


No other roof deck material gives you
so much insulation... with so much
strength... at so little weight!
Permalite Insulating Concrete

The figures tell the story

INSULATION 1:6 mix portland cement and Permalite expanded perlite aggregate has a "k" of 0.58 . . ."U" value of .219 for a 2" thickness with built-up roof.

STRENGTH 1:6 mix has compressive strength of 180 psi – nearly 13 tons/sq. ft. For greater strength, a 1:4 mix provides 440 psi – more than 31 tons/sq. ft.

WEIGHT 1:6 mix has dry density of 27 lb./cu. ft. A 2" thick slab weighs only 4½ lb./ sq. ft.

Fire safe. Handled and placed like any ordinary concrete. Easily sloped to drain. Can't rot . . . vermin proof . . . termite-proof. For the complete story, see your Sweets File, or write

Permalite® THE LARGEST SELLING PERLITE AGGREGATE IN THE WORLD

Permalite aggregate is produced by licensed franchisees from perlite ore mined by Great Lakes Carbon Corporation.
Perlite Department, *Great Lakes Carbon Corp., 612 S. Flower St., Los Angeles 17, Calif.*

$225,000. Client, Village of East Hazel Crest, Illinois.

INDIANA

Kenneth W. Dobert, Chester L. Stemp, Consulting Engineers
Gary, Indiana
¶ Sewage treatment plant, pumping station, lift stations, sanitary sewers. (struc., civil, mech., elec.) $500,000. Client, Town of Chesterton.

Kenneth W. Dobert & Associates
Crown Point, Indiana
¶ Sewage treatment plant, alterations to existing sewage treatment plant, lift stations, sanitary sewers. (struc., civil, mech., elec.) $75,000. Client, Hermit's Lake subdivision.
¶ Sewage treatment plant, Hobart, Indiana. (struc., civil, mech., elec.) $30,000. Client, Viking Village subdivision.
¶ Sewage treatment plant, Hobart, Indiana. (struc., civil, mech., elec.) $50,000. Client, Lake George Plateau subdivision.
¶ Sewage treatment plant, Merrillville, Ind. (struc., civil, mech., elec.) $100,000. Client, Turkey Creek subdivision.
¶ Sewage treatment plant, Gary, Indiana. (struc., civil, mech., elec.) $30,000. Client, Melody Lane Trailer Ranch.

IOWA

Bartels & McMahan Engineering Company
Dubuque, Iowa
¶ Dredging and land fill for industrial sites. (civil) $128,000. Client, Board of Dock Commissioners, Dubuque, Iowa.
¶ Sanitary sewage pumping station. (civil) $25,000. Client, Board of Dock Commissioners, City of Dubuque, Iowa.
¶ Water main on East 12th Street. (civil) $10,000. Client, Board of Dock Commissioners, City of Dubuque, Iowa.
¶ Garage building. (struc.) $24,000. Client, River Trails Bus Company.
¶ County roads. (civil) $100,000. Client, Dubuque County, Iowa.
¶ Sewer system. (civil) $180,000. Client, Epworth, Iowa.
¶ Subdivision. (civil) $100,000. Client, Schiltz Construction Co., Dubuque, Ia.
¶ Subdivision. (civil) $100,000. Client, Mettel Realty & Investment Company, Dubuque, Iowa.
¶ Subdivision. (civil) $100,000. Client, Hillcrest Builders, Dubuque, Iowa.
¶ Subdivision. (civil) $40,000. Client, Steger Construction Co., Dubuque, Ia.
¶ Subdivision. (civil) $150,000. Client, William Reilly, Dubuque, Iowa.
¶ Subdivision. (civil) $100,000. Client, Wallis, Allen, Dubuque, Iowa.
¶ Street improvements. (civil) $175,000. Client, Monticello, Iowa.
¶ Street improvements. (civil) $120,000. Client, Cascade, Iowa.

Moore & Bouse
Cedar Rapids, Iowa
¶ Junior high school, Linn County. (mech., elec.) $350,000. Client, Crites, Peiffer & McConnell.
¶ Chemistry building, University of

Six steps to better curbing with Penn Ventilator

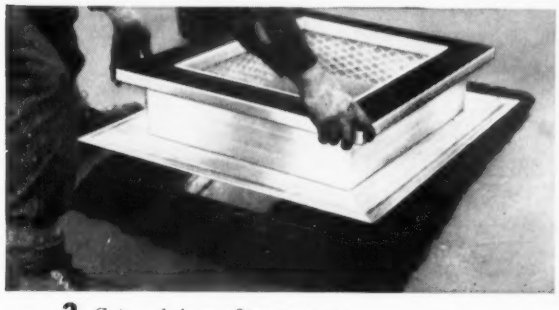
SELF-FLASHING EXTRUDED ALUMINUM SONOTROL CURB

That's all there is to it. It's the biggest advance yet in roofing curbs. Eliminates errors in the field . . . no more coordinating, flashing and waiting. You just place your order when roof opening dimensions are set . . . and the curb is delivered when you need it. Penn Ventilator is the single source of responsibility. You get ventilator, curb and damper . . . and everything fits.

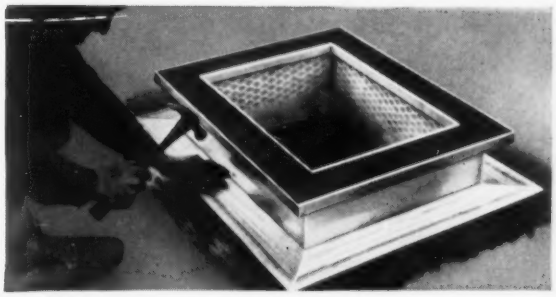
The self-flashing feature keeps units low to the roof and is used and approved by leading roofing material manufacturers. All-aluminum construction of the new Sonotrol Curb reduces roof loading, saves time, makes it easy to handle. "I" beam design adds to its sturdiness. It's nonporous and weathertight, includes an integral neoprene-rubber gasket. Special acoustical insulated lining provides for sound attenuation, and eliminates condensation.

Get complete details on this revolutionary self-flashing Sonotrol Curb that actually costs no more than the "hit-or-miss" method of field construction. Your nearby Penn Ventilator man has a sample section to show you.

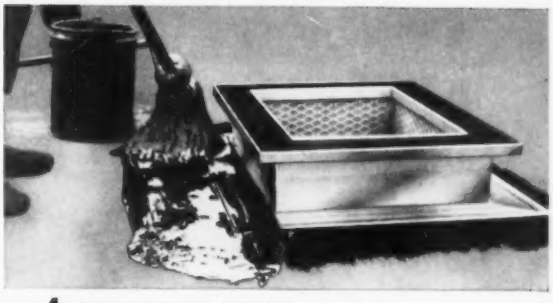
1. Butter 12" wide bed of plastic roofing cement around roof opening.



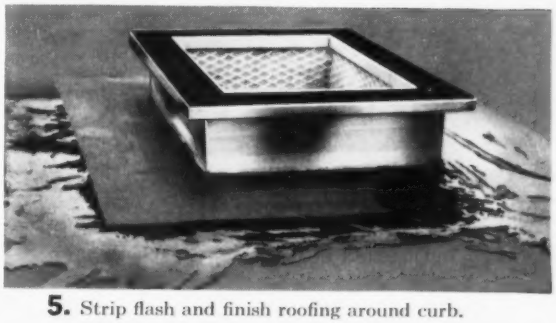
2. Set curb in roofing cement.



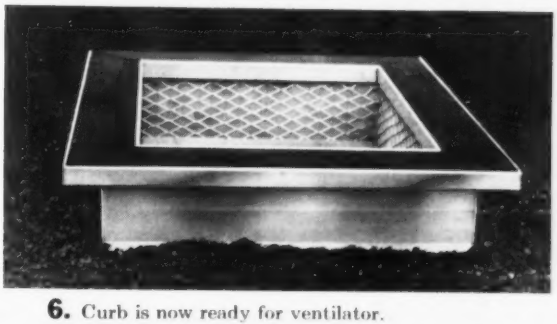
3. Fasten curb to roof deck.



4. Prime for strip flashing.



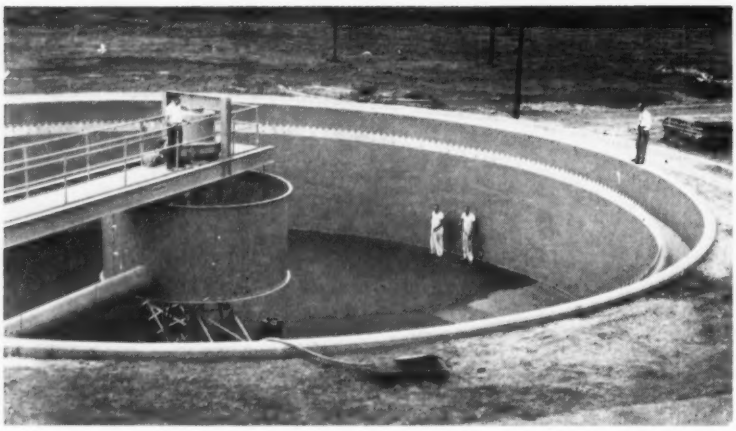
5. Strip flash and finish roofing around curb.



6. Curb is now ready for ventilator.

PENN VENTILATOR CO., INC.
GOODMAN & ALLEGHENY, Philadelphia 40, Pa.
Representatives and Distributors in Principal Cities
Charter member of AMCA

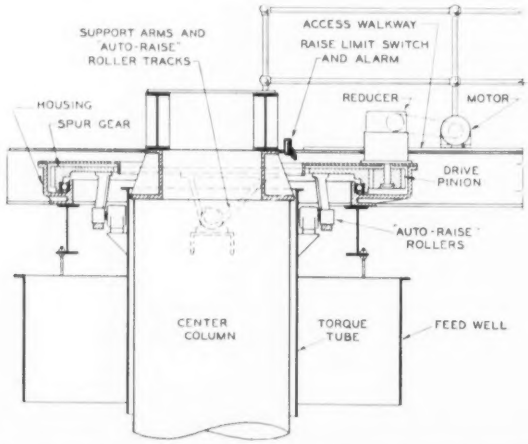
A Leading Manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 25 years.



PAPER MILL INSTALLS SECOND HARDINGE CLARIFIER FOR WASTE TREATMENT

The P. H. Glatfelter Company, paper manufacturers at Spring Grove, Pa., have gone a step farther in keeping wastes from its manufacturing processes out of the nearby Codorus creek. Recently, a $100,000 addition to its waste treatment plant was put into operation. It is a twin to a Hardinge Clarifier that has been in use for a number of years. Besides doubling the mill's waste treatment capacity, it will help remove more solids from the main effluent flow.

Each clarifier is 75 feet in diameter and 15 feet deep. They hold nearly a million gallons and will provide two hours' settling time for the main effluent on its way to the Codorus. The main waste from the mill is pumped to the clarifier as shown here. The clarifier removes fiber and clay residues from paper processing waters. The average amount taken out of the waste amounts to from 10 to 15 tons a day.



Typical Hardinge Clarifier Drive Mechanism for large, center column supported units. "Auto-Raise" feature lifts the scrapers in case of an overload, preventing breakage. Bulletin 35-D-64.

HARDINGE
COMPANY, INCORPORATED
YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works
New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco • Birmingham • Jacksonville Beach

Iowa. (mech., elec.) $850,000. Client, Brown & Healey.
¶ Fire station, Cedar Rapids, Iowa. (mech., elec.) $160,000. Client, Crites, Peiffer & McConnell.

KENTUCKY

William M. Lewis, Jr.
Portsmouth, Ohio
¶ Four miles 69-kv transmission line, Grays Branch, Ky. to Argentum, Ky. (elec.) $40,000. Client, Grayson Rural Electric Cooperative Corporation.
¶ Twelve miles 69-kv transmission line, New Foundland, Ky. to Maizie, Ky. (elec.) $120,000. Client, Grayson Rural Electric Cooperative Corporation.
¶ 69-kv, 2500-kva substation and maintenance building, Argentum, Kentucky. (elec.) $70,000. Client, Grayson Rural Electric Cooperative Corporation.
¶ 69-kv, 2500-kva substation, switching station, and maintenance building, Leon, Kentucky. (elec.) $100,000. Client, Grayson Rural Electric Cooperative Corp.
¶ 69-kv, 2500-kva substation and maintenance building, Maizie, Kentucky. (elec.) $70,000. Client, Grayson Rural Electric Cooperative Corporation.

MICHIGAN

Smith, Hinchman & Grylls Associates, Inc.
Detroit, Michigan
¶ Wayne Hospital (Ecorse), Detroit, Michigan. (struc., civil, mech., elec.) $16 million. Client, county.
¶ Garden City Hospital, Garden City, Mich. (struc., civil, mech., elec.) $2 million. Client, Osteopathic Hospital Group.
¶ Flint Osteopathic Hospital, Flint, Michigan. (struc., civil, mech., elec.) $3 million. Client, Osteopathic Hospital Group.
¶ Flat Rock Hospital, Flat Rock, Michigan. (struc., civil, mech., elec.) $2 million. Client, Osteopathic Hospital Group.

Finkbeiner, Pettis & Strout
Toledo, Ohio
¶ Sewers and sewage treatment, Onsted, Michigan. Preliminary report. Client, Village of Onsted, Michigan.

Harold N. Davidson
Kalamazoo, Michigan
¶ Police and municipal court building, Kalamazoo, Mich. (struc.) $750,000. Client, Stapert, Pratt, Bulthuis, Sprau & Crothers, architects.

MINNESOTA

Jos. V. Edeskuty & Associates
Minneapolis, Minnesota
¶ Electrical distribution primary network system substation, underground 13.8 kv. (civil, elec.) $320,000. Client, City of Austin, Minnesota.

MISSOURI

Albright & Friel, Inc.
Philadelphia, Pennsylvania
¶ Expansion of sewage treatment plant, Rehobeth Beach, Missouri. (struc., civil,

Part of the University of Kentucky's Cooperstown Project—seven buildings containing 330 apartments for married students

Architect: Brock & Johnson, Lexington, Ky.
Engineer: Stagg & Fisher, Lexington, Ky.
Heating Contractor: George Pridemore & Son, Inc., Lexington, Ky.
Distributor: Plumbers Supply Co., Lexington, Ky.

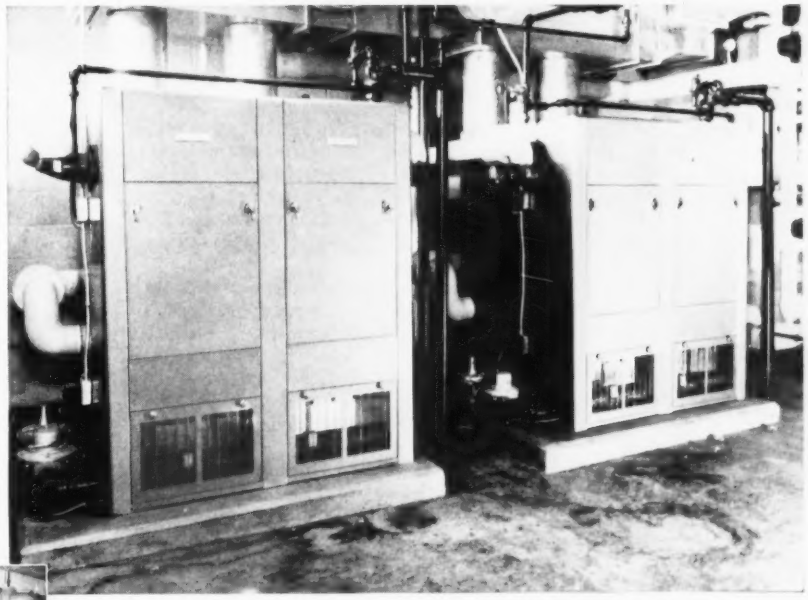
MODERN UNIVERSITY HOUSING HEATED BY 24 WEIL-McLAIN MODERN TYPE "J" GAS BOILERS

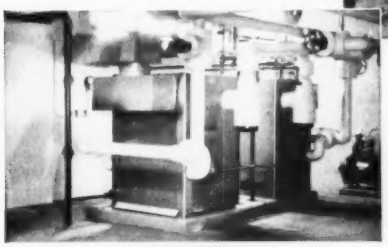
For this handsome student housing project and its mate, the five-building Shawneetown Project, University of Kentucky officials selected Weil-McLain Type "J" Cast Iron Gas Boilers. Selection was based on the performance and dependability characteristics of these modern heating units.

A total of twenty-four boilers is installed to heat the buildings of the two projects. The wide range of sizes in which Type "J" Boilers are available permits accurate sizing to any heating requirement.

WEIL-McLAIN TYPE "J" BOILERS OFFER THESE FEATURES FOR ECONOMY, DEPENDABILITY, LONG LIFE:

1. Made of cast iron—corrosion-resistant.
2. AGA approved minimum efficiency of 80%.
3. Develop full capacity as rated by I=B=R.
4. Compact design saves space—up to 40%.
5. AGA approved for all gases.
6. Available with AGA approved dual fuel manifold.
7. Electronic controls available as engineered part of unit.
8. Only a vent required to carry off products of combustion.
9. Lower maintenance—easily cleaned, no refractories, no motors, no fans, no tube replacement, no water treatment.
10. Can be assembled at any stage of building construction. Sections pass through ordinary door.
11. Capacity easily increased by adding sections.





Weil-McLain Type "J" Boilers as installed at University of Kentucky

Send for descriptive literature

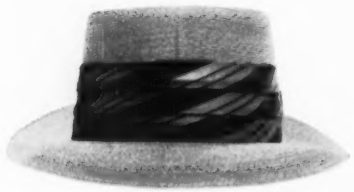
WEIL-McLAIN TYPE "J" CAST IRON GAS BOILERS

WEIL-McLAIN BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. DD-69.

YOUR CLIENT:



will he love you in AUGUST

. . . as he did in MARCH?

Too often electrical systems look bad in the summertime. High ambient temperatures trick thermal protective devices into tripping at points well below rated capacity. Electric typewriters stop half-way through important contracts . . . air conditioners stop conditioning . . . and the executive boiling point drops to dangerous levels.

You can avoid such seasonal circuit troubles (and client dissatisfaction) by specifying Heinemann circuit breakers.

What's so special about Heinemann breakers? The exclusive hydraulic-magnetic operating principle: it eliminates all thermal elements. Ambient temperatures can soar or slide, but Heinemann breakers *always* interrupt at specified trip points . . . *always* carry their full rated capacity. Derating is never necessary.

And, Heinemann breakers interrupt instantaneously under short circuit conditions (at a realistic 1000% of the breaker's current rating) . . . prevent needless circuit interruption with a controlled time delay that allows for harmless, transient overloads.

Specifications calling for Heinemann circuit breakers provide the finest protection available. Protection that more than pays for itself in terms of year-round efficiency and client satisfaction.

Interested? You'll find all the facts and specifications on Heinemann panelboard circuit breakers in Bulletin 3103. Send for a copy.

HEINEMANN

HEINEMANN ELECTRIC COMPANY
127 Plum Street, Trenton 2, N. J.

Circuit breakers

mech., elec.) $350,000. Client, City of Rehobeth Beach, Missouri.

MONTANA

T. T. Heberly, Consulting Engineer
Havre, Montana
¶ 1800 miles of telephone line including five central offices. (elec.) $1.5 million. Client, Triangle Telephone Association.
¶ System study for Sun River Electric Cooperative. (elec.) Client, Sun River Electric Cooperative.

R. L. Prussing Engineers
Billings, Montana
¶ Montana State College, boiler plant. (mech.) $225,000. Client, Montana.
¶ Montana State College, women's dormitory #2. (mech.) $300,000. Client, architect.
¶ Montana State capitol remodeling. (mech.) $1 million. Client, architect.
¶ Yellowstone Park Co. service station. (mech.) $20,000. Client, owner.
¶ St. Vincent's Hospital boiler plant. (mech.) $150,000. Client, owner.
¶ Three Forks, remodeling of school heating. (mech.) $15,000. Client, owner.
¶ Security Bank, Bozeman, Montana. (mech.) $200,000. Client, architect.
¶ Powell high school. (mech.) $300,000. Client, architect.
¶ Hardin schools. (mech.) $250,000. Client, architect.
¶ Glasgow Air Force school addition. (mech.) $50,000. Client, architect.
¶ Northern Montana College men's dormitory addition. (mech.) $60,000. Client, architect.
¶ Old peoples home, Sidney, Montana. (mech.) $75,000. Client, architect.

NEBRASKA

Fulton & Cramer
Lincoln, Nebraska
¶ Municipal power plant expansion, Sutherland, Nebraska. (mech., elec.) $200,000. Client, Village of Sutherland.
¶ Municipal power plant expansion, Madison, Nebraska. (mech., elec.) $180,000. Client, City of Madison.
¶ Municipal power plant expansion, Kimball, Nebraska. (mech., elec.) $500,000. Client, City of Kimball.
¶ Paving, Kimball, Nebraska. (civil) $150,000. Client, City of Kimball.
¶ Sewage treatment plant, Plainview, Nebraska. (civil) $100,000. Client, City of Plainview.

NEW JERSEY

Bogert & Childs
New York, New York
¶ Stage 2, trunk sewer and expansion of existing sewage treatment plant, Bergen County, New Jersey. (civil, struc., mech., elec.) $22 million. Client, Bergen County Sewer Authority.

H. A. Martin Associates
New York, New York
¶ Sewage disposal system for St. Leo The Great church and school, Lincroft,

This propane tank wall shrinks... but free-standing **FOAMGLAS**® solves the insulation problem

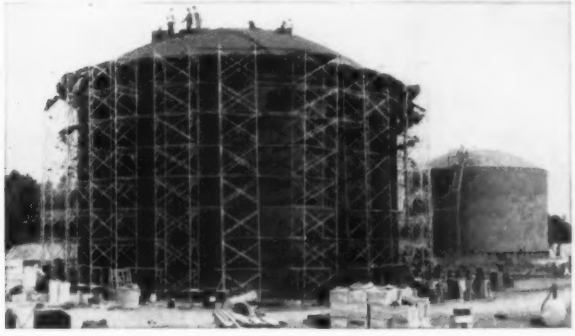
The strength of FOAMGLAS solved an unusual insulation problem posed by contracting tank walls in the nation's first refrigerated propane storage plant. Designed and built by Stone & Webster Engineering Corp., for the Atlanta Gas Light Company, the storage facilities at Riverdale, Georgia, consist of three steel tanks. Each is 70 ft. in diameter and 52 ft. high with a capacity of 1,297,500 gallons of refrigerated propane.

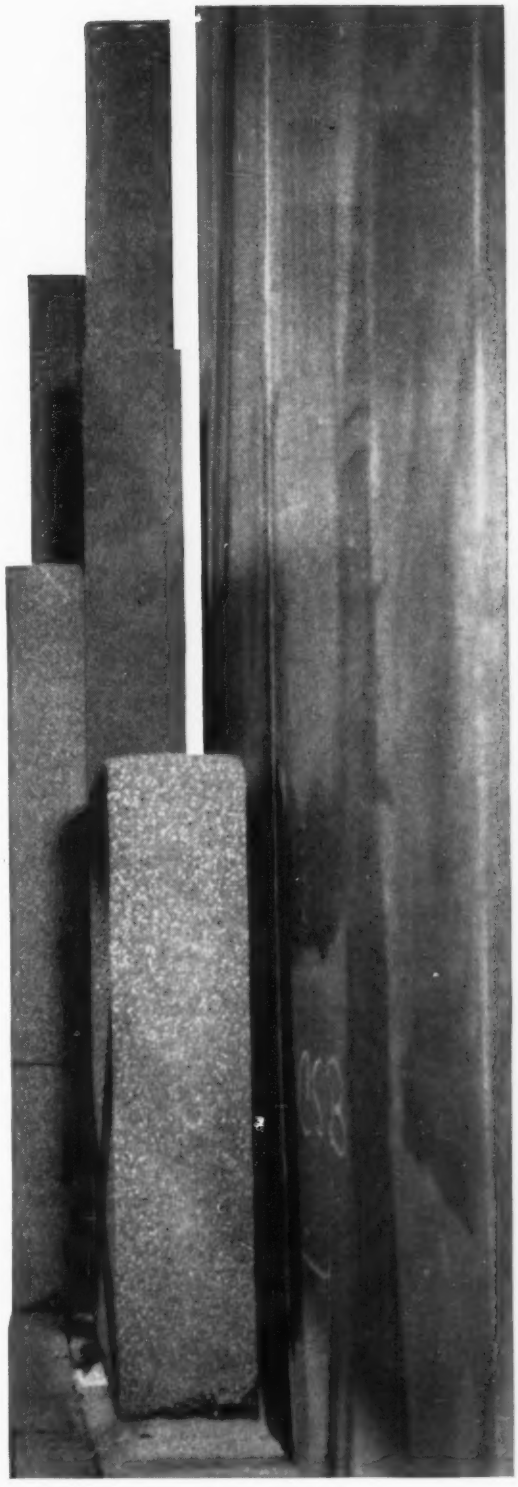
When the tanks are pulled down to an operating temperature of —46°F., their walls contract. Ordinary insulations—applied in direct contact with the tank walls —just won't work. But the unique strength of FOAMGLAS permits its use as a free standing wall of insulation . . . self-supporting and separated from the tank walls by an air space. The same high compressive strength permitted placing FOAMGLAS beneath the tank floors as well as on the tank roofs.

Insulating performance? FOAMGLAS is completely moisture-proof to insure constant high insulating value for the life of the tanks . . . prevent condensation or freezing of moisture between insulation and tank walls. And since FOAMGLAS can't absorb volatile hydrocarbons, it never becomes a fire hazard.

Check the unique combination of benefits offered only by FOAMGLAS. Write Pittsburgh Corning Corporation, Dept. R-69, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Quebec.

Pittsburgh Corning offers a complete line of mastics, tank coatings and other accessory materials specifically designed for use with FOAMGLAS.





PITTSBURGH PC CORNING

EVERY ENGINEER will want these FACTS!

NEW EDITION
Bulletin No. 31-A

Other Types of Thermal Expansion Piping Problems Economically Solved by Barco Ball Joints
Space-Saving Expansion Loops Made With Ball Joint Fittings
How to Solve Piping Flexibility Problems
BARCO BALL JOINTS
THERMAL EXPANSION AND CONTRACTION

"HOW TO SOLVE

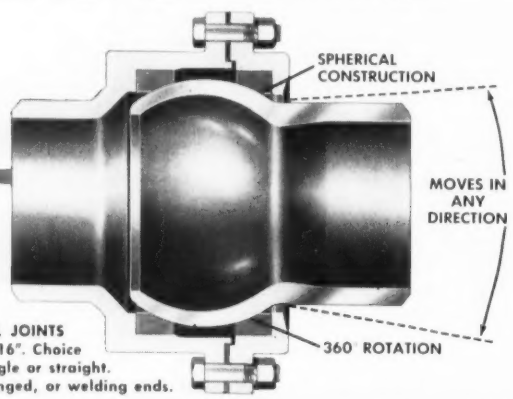
PIPE EXPANSION

PROBLEMS"

TODAY there is an easier way to accommodate *thermal expansion* in piping! No need to install special devices—in virtually every instance, you can put *flexibility* right in the line itself with standard BARCO BALL JOINTS:

1. **SUPERIOR METHOD.** New Steam Power Stations . . . Oil Refineries . . . Chemical Plants . . . Paper Mills . . . Office Buildings . . . Schools now are using this money-saving method.
2. **LONG LIFE.** No rubber, no thin metal members subject to fatigue or "blow-out." No lubrication, no grease packing. Self-adjusting; pressure sealing.
3. **FIRE-SAFE.** The joints have passed rigid fire, high temperature, and water quench tests.
4. **SAVE SPACE, CUT COSTS.** No pressure thrust—expensive anchoring or bracing not required to hold piping in place or in line. Cuts space required for pipe loops and U-bends.
5. **VERSATILE.** Easy to handle compound twisting movements, wide variations in temperature and pressure—steam, air, oil, water, gas and chemicals.

SEE your Barco Representative for information or write. Ask for the new revised Bulletin No. 31-A, "How to Solve Piping Flexibility Problems." *Engineering recommendations on request.*



BARCO BALL JOINTS
Sizes ½" to 16". Choice of styles, angle or straight. Screwed, flanged, or welding ends.

BARCO MANUFACTURING CO.
572G Hough Street • Barrington, Illinois

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
In Canada: The Holden Co., Ltd., Montreal

Middletown, New Jersey. (civil) $25,000. Client, Thomas Henry Moran, architect.

Michael M. Burris
Englewood, New Jersey
¶ Hudson County Mental Diseases Hospital, Hudson County, New Jersey. (civil) Client, Barnett Singer, architect.
¶ Housing for the elderly, Paterson, N. J. (civil) Client, Kelly and Gruzen, archs.
¶ Tenafly drainage study, Phase 2, Tenafly, N. J. Client, private developers.

NEW YORK

Smith, Hinchman & Grylls Associates, Inc.
Detroit, Michigan
¶ Chevrolet foundry plant, Massena, N. Y. (struc., civil, mech, elec.) $20 million. Client, General Motors Corp.

Milton Alpern, P.E.
Wantagh, L.I., New York
¶ Alteration of apartment buildings into modern apartments – conversion of two buildings into one, New York City. (struc.) $250,000. Client, Rupeg Realty.

Joseph S. Ward
Caldwell, New Jersey
¶ Imperial House, 28-story apartment house, New York City. (soil and foundation studies) $20 million. Client, Fisher Brothers, owner.

James N. DeSerio, P.E.
Buffalo, New York
¶ Gypsum block manufacturing plant, Bronx, N. Y. (civil, struc., mech., elec.) $1 million. Client, National Gypsum Co.

Michael M. Burris
Englewood, New Jersey
¶ Rockland Village Subdivision, 262 individual homes, Orangeburg and Blauvelt, New York. (civil) $5 million. Client, Atlantic Realty Associates.
¶ Bronx State Hospital, Phase 1, The Bronx, New York. (site grading, roads, landscape) Client, Urbahn & Hart, arch.

John H. Sheehan
Mechanicville, New York
¶ Water distribution system. (civil) $104,500. Client, Schaghticoke, N. Y.

Donald E. Brill, P.E.
Williamsville, New York
¶ Remodel office building. (struc.) $35,000. Client, Lutwack, Parrino & Maurin.
¶ Warehouse and offices. (struc.) $225,000. Client, Milton Milstein, architect.
¶ Three gasoline stations. (civil) $30,000 each. Client, Gulf Oil Corporation.
¶ Subdivision. (civil) $60,000. Client, Bartel Subdivision, Inc.
¶ Subdivision. (civil) $150,000. Client, Chester Heiman.

Henry J. Campbell, Jr.
Mineola, New York
¶ New firehouse, Bay Shore Fire District, Bay Shore, New York. (mech., elec.) Client, Eugene S. Helbig, arch.
¶ New factory, warehouse, and office building, 30,000 sq ft, Roosevelt Field

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Good interior design includes lighting of the highest quality. That is why so many handsome interiors are lighted with equipment incorporating PLEXIGLAS® acrylic plastic diffusers. With PLEXIGLAS, you can be sure of clean, pleasing appearance, and highest efficiency in transmission and diffusion of light. In addition, the high quality of your lighting *lasts*, because PLEXIGLAS stays free from discoloration on long exposure to fluorescent light, resists breakage, is a rigid material with a smooth, easily cleaned surface.

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Industrial Area, Roosevelt Field, New York. (mech., elec.) Client, John Harold Barry, architect.

¶ Utility site development for two new industrial areas composed of nine buildings, Roosevelt Field Industrial Area, Roosevelt Field, New York. (mech., elec.) Client, John Harold Barry, arch.

¶ Delson, Levin & Gordon law offices, New York, New York. Alterations and modernization of existing building including installation of air conditioning. (mech., elec.) Client, Raymond & Rado, architects.

¶ Syosset Community Hospital, Syosset, New York. New 200-bed general hospital. (mech., elec.) Client, Risso, Nelson & Pope, consulting engineers and Siegmund Spiegel, architect.

Sheehan Schweizer Associates
Buffalo, New York

¶ Public School 91, Buffalo, New York. 1½-story, 40 classrooms, office area, natatorium, gymnasium, cafeteria, auditorium. (mech.) $2 million. Client, James, Meadows and Howard, architects.

¶ Health and science building, University of Buffalo, New York. 3-story, laboratories, offices, instructional areas. (mech.) $2,750,000. Client, James, Meadows and Howard, architects.

¶ Shopping center, East Aurora, New York. (civil, mech., elec.) $2 million. Client, Nichols and Pearlman, architects.

¶ Public School 8, Buffalo, New York. 30-classroom addition with new boiler room for complete building. (mech., elec.) $750,000. Client, A. A. Rumschik, architect.

¶ ParkEdge supermarket, Tonawanda, New York. (mech.) $500,000. Client, Milton Milstein and Associates, arch.

¶ Soft-drink bottling plant, Cheektowaga, New York. (mech., elec.) $250,000. Client, Milton Milstein and Associates, arch.

¶ County Detention Home for Boys, Buffalo, N.Y. (mech., elec.) $150,000. Client, Milton Milstein and Associates, arch.

¶ Three-story office building, Niagara Falls, New York. (mech., elec.) $200,000. Client, Highland and Highland, arch.

¶ Church, Orchard Park, New York. (mech., elec.) $150,000. Client, Highland and Highland, architects.

Gennaro Mianulli
Brooklyn, New York

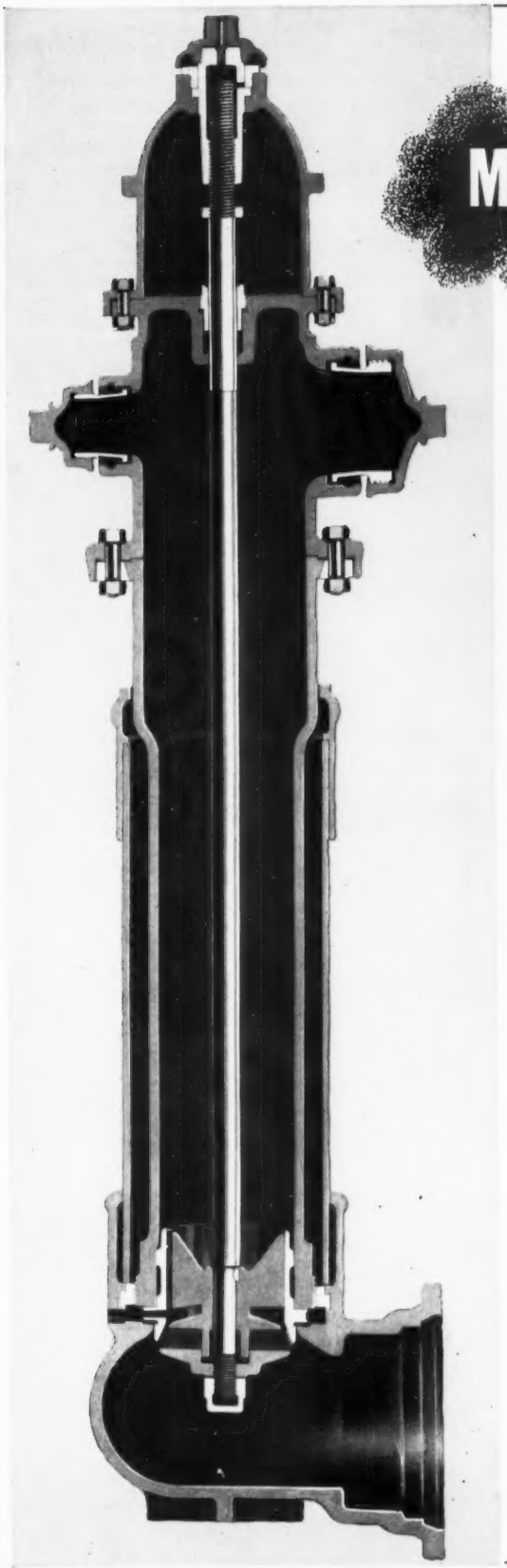
¶ Jewish center of East Flatbush civic center, Brooklyn, New York. (struc.) $200,000. Client, Michael W. Frudais, architect.

¶ Gasoline station, Brooklyn, New York. (struc.) $50,000. Client, Michael W. Frudais, architect.

P. Anthony Sarubbi, P.E.
Yonkers, New York

¶ Self-service laundromat, Yonkers, New York. Complete design and layout of structure and equipment including architectural design. (struc., mech., elec.) $26,000. Client, Park Hill Laundromat.

¶ Crown Carpet Shop, Yonkers, New York. One-story showroom, structural steel and masonry bearing walls, long-



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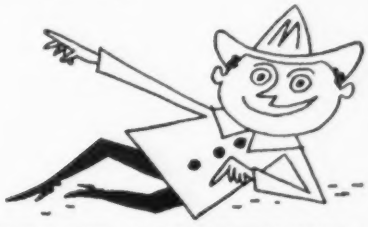

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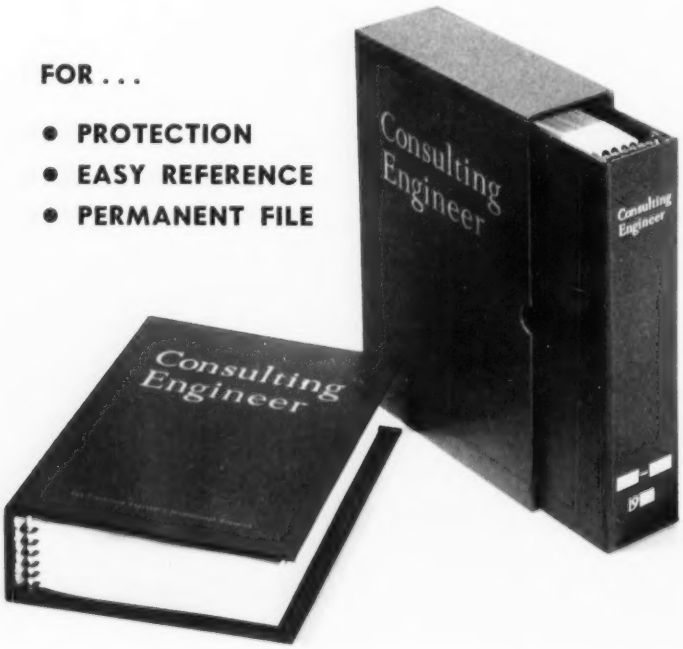

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span joists, concrete retaining walls. (civil, struc.) $110,000. Client, M. A. Capobianco, architect.

NORTH CAROLINA

William F. Freeman, Inc.
High Point, North Carolina

¶ West side sewage treatment plant and outfall, High Point, North Carolina. (civil, struc., mech., elec.) $1 million. Client, City of High Point, N.C.

¶ Additions to water filtration plant and raw water station, High Point, North Carolina. (civil, struc., mech., elec.) $1.4 million. Client, High Point, N. C.

¶ East side sewage plant and 15-mile outfall, High Point, North Carolina. (civil, struc., mech., elec.) $2.2 million. Client, City of High Point, N. C.

¶ Sewage treatment plant and outfall, Greenville, N.C. (civil, struc., mech., elec.) $1,750,000. Client, Greenville, N.C.

¶ Sewage treatment plant and outfalls, force mains, pumping stations, Edenton, North Carolina. (civil, struc., mech., elec.) $500,000. Client, Edenton, N.C.

¶ Sewage treatment plant and outfalls, force mains, pumping station, Madison, North Carolina. (civil, struc., mech., elec.) $425,000. Client, Madison, N.C.

¶ Sewage treatment plant and outfalls, force main, pumping stations, Weldon, North Carolina. (civil, struc., mech., elec.) $400,000. Client, Weldon, N.C.

¶ Sewage treatment plant, collection system, pumping stations, outfalls, Jamestown, N.C. (civil, struc., mech., elec.) $675,000. Client, Jamestown, N.C.

¶ Raw water intake and raw water line, Sanford, N.C. (civil, struc., mech., elec.) $425,000. Client, Sanford, N.C.

OHIO

Proctor, Ingels & Stauss
Cincinnati, Ohio

¶ Saint Mary's Hospital. (mech., elec.) $5 million. Client, Potter, Tyler, Martin and Roth, architects.

¶ Hamilton County communication center. (mech., elec.) $250,000. Client, Glaser & Myers, architects.

G. M. Goldsmith
Cincinnati, Ohio

¶ Design laboratory building, Cincinnati, Ohio. (struc.) $54,000. Client, engineer.

¶ Remodel salesroom and office, Cincinnati. (struc.) $25,000. Client, engineer.

¶ Design warehouse, Norwood, Ohio. (struc.) $25,000. Client, Standard Overall Dry Cleaning Company.

Finkbeiner, Pettis & Strout
Toledo, Ohio

¶ Waterworks improvements, Bluffton, Ohio. Preliminary report. Client, Village of Bluffton, Ohio.

¶ Waterworks improvements, Genoa, Ohio. Preliminary report. Client, Village of Genoa, Ohio.

¶ Relief sewers, Van Wert, Ohio. Preliminary report. Client, Van Wert, Ohio.

¶ Sewage treatment plant improvements, Bowling Green, Ohio. Detail plans and

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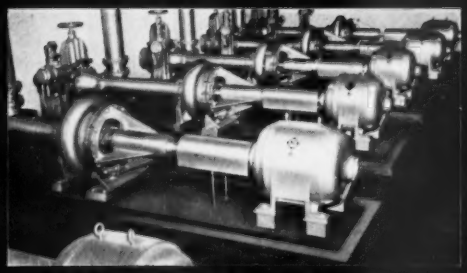

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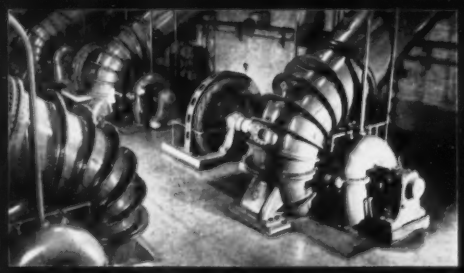
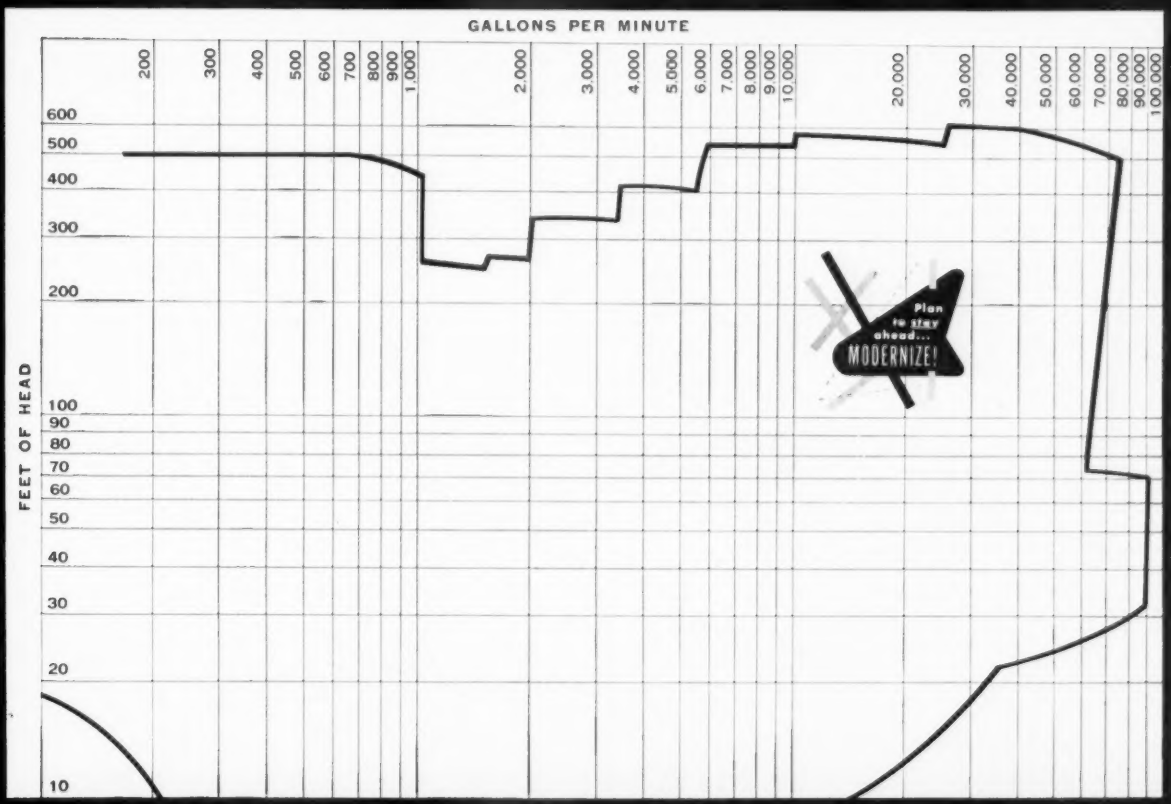


Main station application involves 12 A-C 72-inch Type SP pumps like that shown.



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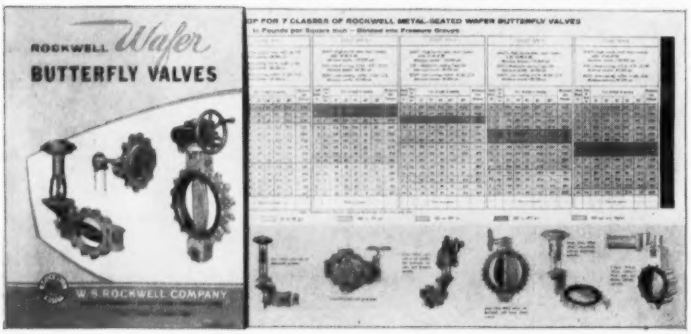

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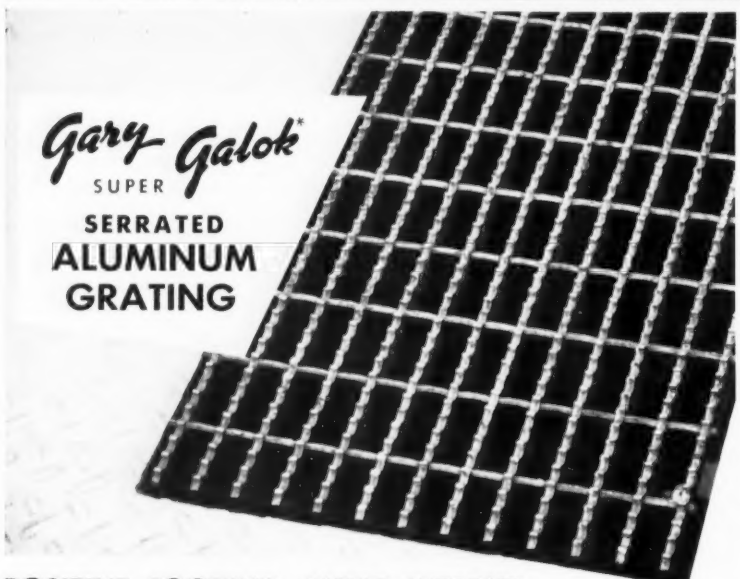

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specifications. (civil, struc., mech., elec.) $500,000. Client, Bowling Green, Ohio.
¶ Sewage treatment plant improvements, Bryan, Ohio. Detail plans and specifications. (civil, struc., mech., elec.) $400,000. Client, City of Bryan, Ohio.
¶ Sewage treatment plant improvements, Convoy, Ohio. Preliminary report. Client, Village of Convoy, Ohio.

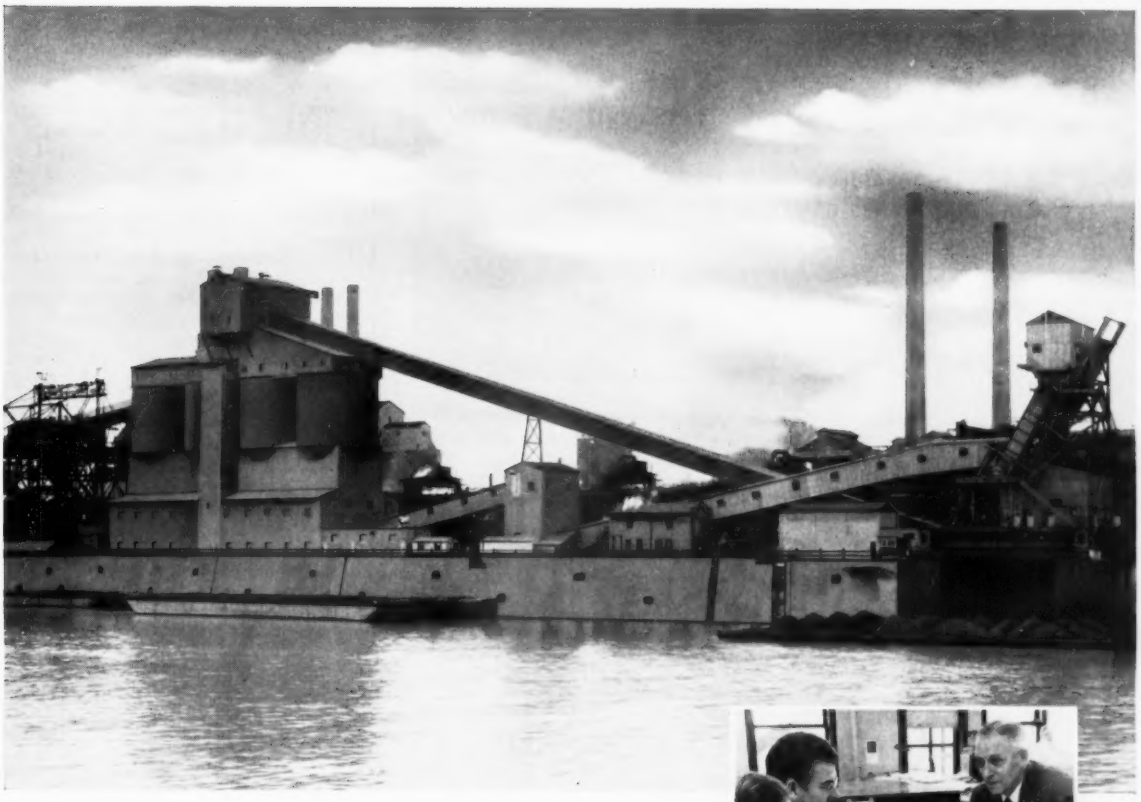
OREGON

Cooper & Rose' & Associates
Portland, Oregon
¶ F. H. Dammasch State Hospital, Phase II, Wilsonville, Oregon. (struc.) $4 million. Client, Stanton, Boles, Maguire & Church, architects.
¶ Terwilliger Plaza apartment building, Portland, Oregon. (struc.) $3,180,000. Client, Smith-Phillips Company.
¶ Warehouse addition and alteration, Portland, Oregon. (struc.) $621,770. Client, Meier & Frank Co., Inc.
¶ Oregon State Labor & Industry building, Salem, Oregon. (struc.) $3.2 million. Client, Skidmore, Owings & Merrill, architects.
¶ Grant high school library, Portland, Oregon. (struc.) $235,000. Client, Whitney, Hinson & Jacobsen, architects.
¶ Humboldt school, Portland, Oregon. (struc.) $323,000. Client, Williams & Martin, architects.
¶ Group of seven buildings and chapel, Emanuel Hospital, addition to nurses home, reinforced concrete, Portland, Oregon. (struc.) $950,000. Client, Church, Newberry & Roehr, architects.

Delmar L. McConnell
Portland, Oregon
¶ Design combination hangar and office building, Seattle-Tacoma International Airport. (struc.) $1,250,000. Client, Pacific Northern Airlines, Inc.

PENNSYLVANIA

Albright & Friel, Inc.
Philadelphia, Pennsylvania
¶ Sewage treatment plant, Ambler, Pa. (struc., civil, mech., elec.) $850,000. Client, Borough of Ambler.
¶ Sewage treatment plant, Burnham, Pa. (struc., civil, mech., elec.) $485,000. Client, Burnham Borough Authority.
¶ Standby pumping station, Pine Grove water filtration plant, Pine Grove, Pa. (struc., civil, mech., elec.) $750,000. Client, Chester Municipal Authority.
¶ Four additional 10-mgd tanks at Village Green, Pa. (struc., civil) $2,250,000. Client, Chester Municipal Auth.
¶ Sewage treatment plant, intercepting and branch sewers, Middletown, Pa. (struc., civil, mech., elec.) $1 million. Client, Middletown Borough Authority.
¶ Sanitary sewers, Plymouth Township, Pa. (civil) $1.5 million. Client, Plymouth Township Municipal Authority.
¶ Sanitary Sewers, East Norriton Township, Pa. (civil) $1.4 million. Client, East Norriton Township Authority.
¶ Sewage treatment plant, Plymouth and East Norriton Township, Pa. (struc., civ-



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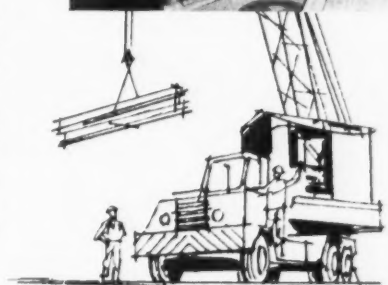

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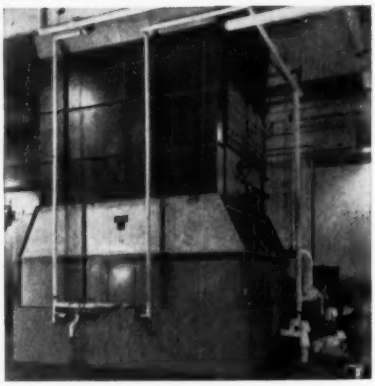

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il, mech., elec.) $900,000. Client, East Norriton-Plymouth Township Authority.
¶ Expansion of sewage treatment plant, York, Pa. (struc., civil, mech., elec.) $1.6 million. Client, York Sewer Authority.
¶ Expansion of sewage treatment plant, Abington, Pa. (struc., civil, mech., elec.) $500,000. Client, Commissioners of Abington Township.
¶ Section of Delaware Expressway, Philadelphia, Pa. (struc., civil) $14 million. Client, Commonwealth of Pennsylvania.
¶ Roosevelt Boulevard improvements, Philadelphia. (struc., civil) $6 million. Client, Commonwealth of Pennsylvania.
¶ Washington Avenue improvements, Philadelphia, Pa. (struc., civil) $5 million. Client, City of Philadelphia.

Harris, Henry & Potter, Inc.
Doylestown, Pennsylvania
¶ Water department integrated electronic load control system, Philadelphia, Pa., consisting of primary sensing devices and transducers, telemetering transmitters and receivers, microwave relay stations, supervisory control equipment, and data logger, scanner, operating console and graphic panel at load control center. $500,000. Client, Philadelphia.

Joseph T. Danko
Pittsburgh, Pennsylvania
¶ McClure high school, White Oak, Pa. (elec.) $201,000. Client, Frank Highberger, architect.
¶ Westmoreland county courthouse renovation, Greensburg, Pa. (elec.) $52,000. Client, Robert Brocker, architect.
¶ Municipal building, McKeesport, Pa. (elec.) $31,000. Client, Celli-Flynn, architect.

William F. Bell, P.E.
Pittsburgh, Pennsylvania
¶ Hilitop Shopping Center, Duquesne, Pa., consisting of Kroger supermarket, restaurant, drugstore, and three other stores, (struc., civil, mech., elec.) $250,000. Client, Senator Frank Kopriver.
¶ Remodel two 4-story buildings, Pittsburgh, Pa. Store fronts, stairways, windows, new plumbing, electrical, and sprinkler system. (struc., civil) $175,000. Client, George Defibaugh, owner.

SOUTH CAROLINA

J. C. Harrison & Associates
Spartanburg, South Carolina
¶ Inman elementary school. (mech.) $350,000. Client, W. M. Hudson, arch.
¶ Gaffney Baptist Church. (mech.) $180,000. Client, Harold Woodward & Associates, architects.
¶ Mary Black Hospital addition. (mech.) $200,000. Client, Mary Black Hospital.
¶ Jonesville elementary school. (mech.) $140,000. Client, Hollis & Roberts.

TENNESSEE

A. E. Bost
Knoxville, Tennessee
¶ North Anderson County Utility District water system. (struc., civil, mech.,

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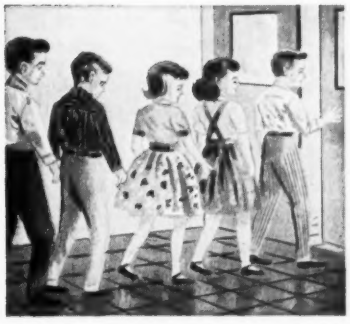

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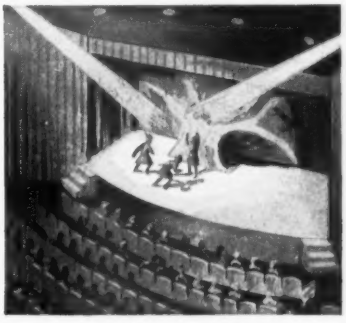

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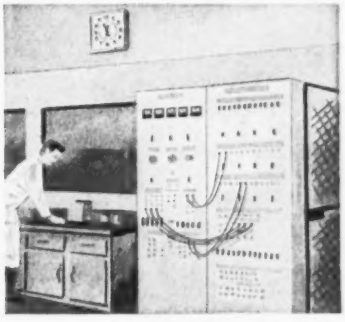

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Forward Curved Blade Blowers for Air Conditioning, Heating and Ventilating Systems. Large air volume with low R.P.M. Smaller space requirements with high mechanical efficiency. Low internal resistance — low shock loss. Engineered for exacting performance. Rugged construction for long life. Use for all industrial and commercial air supply requirements and many exhaust applications. Available in Class 1, Class 2, Class 3, and Class 4 construction.
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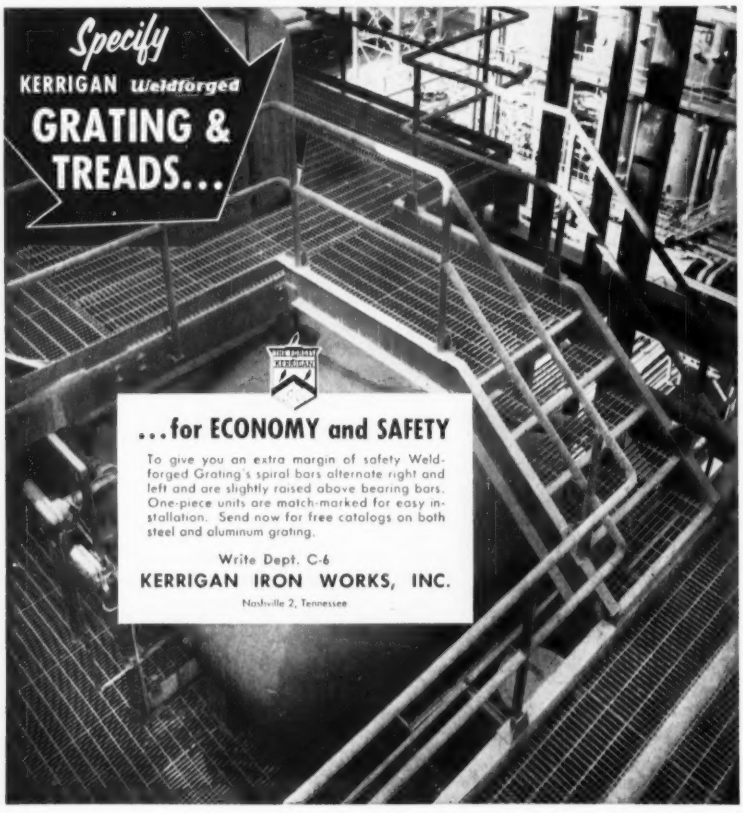
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GRATING & TREADS...
...for ECONOMY and SAFETY
To give you an extra margin of safety Weldforged Grating's spiral bars alternate right and left and are slightly raised above bearing bars. One-piece units are match-marked for easy installation. Send now for free catalogs on both steel and aluminum grating.
Write Dept. C-6
KERRIGAN IRON WORKS, INC.
Nashville 2, Tennessee

elec.) $725,000. Client, North Anderson County Utility District.

¶ Knox Chapman Utility District water system, Knoxville, Tennessee. (struc., civil, mech., elec.) $1,125,000. Client, Knox Chapman Utility District.

¶ South Blount County Utility District water system. (struc., civil, mech., elec.) $1 million. Client, South Blount County Utility District.

¶ Rockford Utility District water system, Blount County. (struc., civil, mech., elec.) $600,000. Client, Rockford Utility District.

¶ Fort Loudoun Utility District water system, Loudoun-Monroe Counties. (struc., civil, mech., elec.) $450,000. Client, Fort Loudoun Utility District.

¶ Cumberland Utility District water system, Roan-Morgan Counties. (struc., civil, mech., elec.) $600,000. Client, Cumberland Utility District.

UTAH

Fuhriman, Hodson & Associates
Provo, Utah

¶ Sewage treatment plant. (civil) $1 million. Client. Orem City, Utah.

¶ Freeway design, near Salt Lake City, Utah. (struc., civil) $2.5 million. Client, Utah State Road Commission.

¶ Water system improvements. (civil) $70,000. Client, Salem City, Utah.

¶ Sewage treatment facilities. (civil) $600,000. Client, Payson City, Utah.

¶ Special improvement project. (civil) $130,000. Client, Payson City, Utah.

¶ Foundation studies at Brigham Young University for four new buildings. (civil) $6 million (value of buildings). Client, Brigham Young University (through architect).

¶ Preliminary studies on location of Red Creek Dam, Fruitland, Utah. (civil) $300,000.

Paul H. Koch, Consulting Engineer
Denver, Colorado

¶ Municipal airport No. 1, Salt Lake City, Utah. (mech.) $3.5 million (total), $720,000 (mech.). Client, Ashton, Evans & Brazier, architects & engineers.

VIRGINIA

Herbert L. Bregman, P.E.
Norfolk, Virginia

¶ Community Methodist Church, Portsmouth, Virginia. (mech., elec.) $20,000. Client, Shriver & Holland, architects.

¶ W. M. Reay Company, Norfolk, Virginia. (mech., elec.) $20,000. Client, Shriver & Holland, architects.

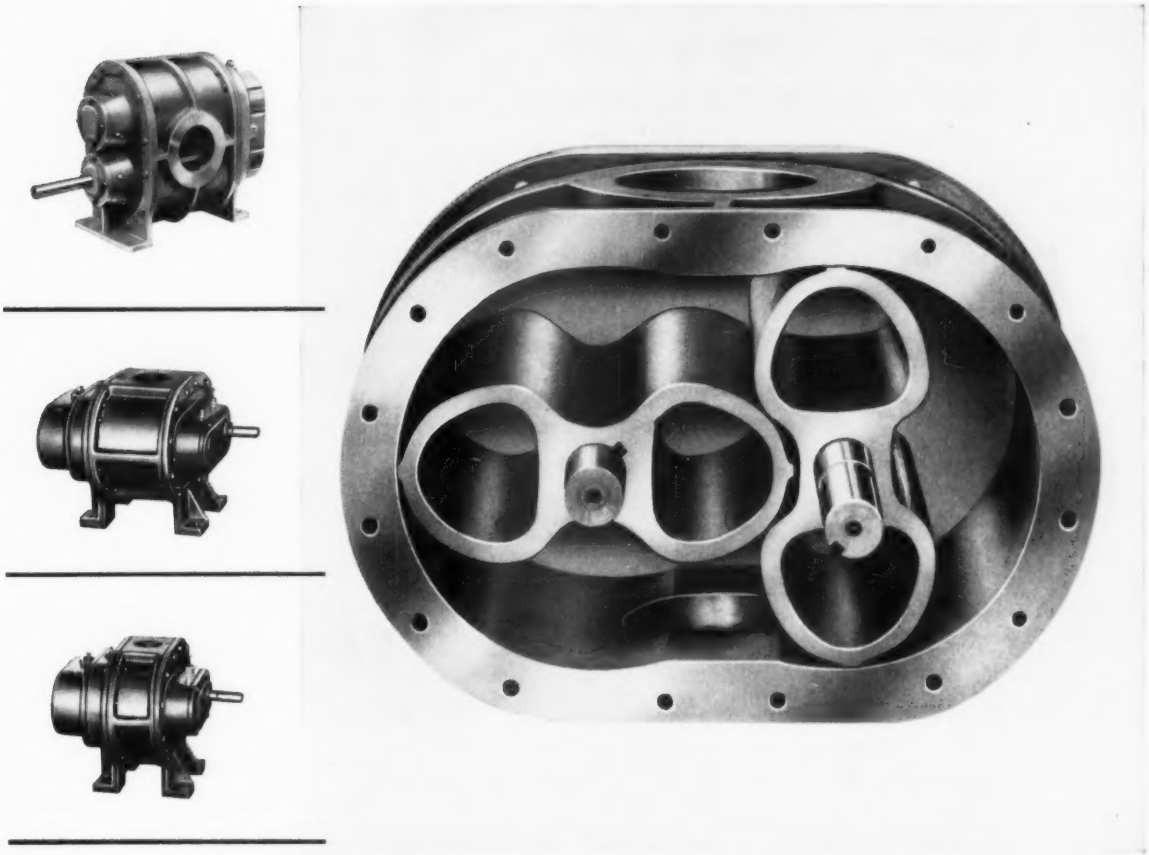
¶ F. W. Woolworth & Co., Princess Anne County, Virginia. (mech.) $30,000. Client, Paul D. Woodward, arch.

¶ Chamberlin Cleaners, Hampton, Virginia. (mech.) $15,000. Client, Architectural Association.

¶ Temple Israel additions and alterations, Norfolk, Virginia. (mech.) $50,000. Client, Leavitt Associates.

¶ Three bowling alleys, Virginia. (mech.) $180,000. Client, owner.

¶ Restaurant and bar and new 3-story



Sutorbilt blowers deliver air or gas at capacities up to 20,000 cubic feet per minute and pressures or vacuums up to 10 pounds. Design incorporates two figure-eight impellers which rotate in opposite direction and deliver a metered volume of air or gas.

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These and other Sutorbilt design features —plus highest-quality manufacturing methods—assure maximum, maintenance-free service from Sutorbilt blowers and gas pumps. Write for illustrated brochure giving complete specifications.

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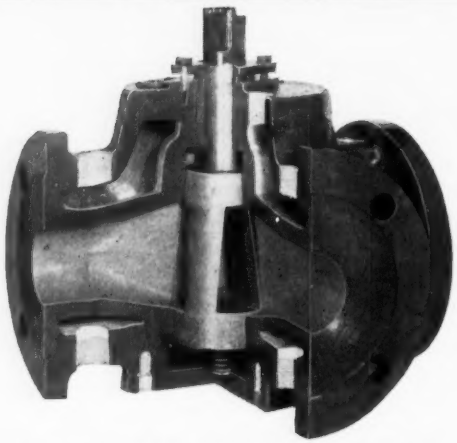
Jacketed Spring Loaded PLUG VALVES

- 2-WAY OR STRAIGHT SPRING LOADED
- 3-WAY SPRING LOADED
- ANGLE SPRING LOADED
- AIR CYLINDER OPERATED SPRING LOADED—*all sizes and types*



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H & B's new fully jacketed spring loaded plug valves feature an inverted tapered plug inserted and lapped into the housing from the bottom of the valve—then spring loaded. The spring wedges the plug to a perfectly tight seal, eliminating troublesome leaks. Easy to operate—no big handwheel . . . no freeze . . . no "breaking loose" necessary. Easy to clean. Made in two port or multi port design, with any special stop arrangement desired.

Bulletin J-57 sent on request

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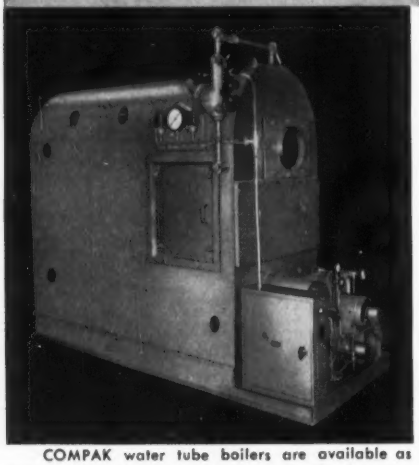

COMPAK water tube boilers are available as completely packaged forced draft units for low or high pressure service in 22 sizes from 12 to 750 HP.

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Manufactured and sold in Canada under agreement with CANADIAN VICKERS LTD. Montreal, P. Q.

building, Norfolk, Virginia. (mech.) $50,000. Client, G. M. Smith, Jr., arch.
¶ Oliver residence, Blacksburg, Virginia. (mech., elec.) $10,000. Client, Shriver & Holland, architects.
¶ Weisberg residence, Portsmouth, Virginia. (mech., elec.) $20,000. Client, Arthur Konikoff, architect.
¶ R & U projects, Fort Story, Virginia. (mech.) $125,000. Client, C. Warren Bogan Associates.

F. W. Scheidenhelm and Associates
New York, New York
¶ Hydroelectric power project involving two dams. Pumped storage and installation of about 320,000 kw. (struc., civil) $45 million. Client, Appalachian Power Co., Roanoke, Va.

WASHINGTON

R. W. Beck and Associates
Seattle, Washington
¶ Design additional facilities, U. S. Air Force station, State of Washington. (civil, struc., mech., elec.) $500,000. Client, Corps of Engineers.
¶ Design hangar modifications, U. S. Air Force station, State of Washington. (mech., elec.) $215,000. Client, U.S.A.F.

Charles E. Kitchin, P.E.
Seattle, Washington
¶ Produce warehouse, Seattle, Washington. (struc.) $600,000. Client, Decker & Christenson, architects.
¶ Greyhound bus depot, Everett, Washington. (struc.) $150,000. Client, Decker & Christenson, architects.

Dean J. Athay
Vancouver, Washington
¶ Vocational school building, State School for Deaf. (elec.) $550,000. Client, Coburn Ackley, architect.
¶ Addition to First Methodist Church, Vancouver, Washington. (elec.) $350,000. Client, Day Hilborn, architect.

WYOMING

Bishop & Spurlock
Lander, Wyoming
¶ Canal system to irrigate 15,000 acres of arid land, located in Sublette County, Wyoming. Main canals to divert from Green River and Cottonwood Creek. $200,000. Client, Green River Development Co., Big Piney, Wyo.

FOREIGN

Harza Engineering Company
Chicago, Illinois
¶ Guayabo hydroelectric project. Expansion underground power station, addition of fourth 15,000-kw unit and 115-kv transmission line, San Salvador to Santa Ana in El Salvador, C. A. $2.4 million. Client, Government of El Salvador (CEL).
¶ Guija control project. Earth dikes, foundation grouting, and approach canal. $2.1 million. Client, Government of El Salvador (CEL). ▲▲

WAGNER Integral-Type Gearmotors

FOR THE POWER YOU WANT AT THE SPEED YOU NEED

Wherever you need "slower than motor speeds" you can get positive speed reduction with plenty of power by using Wagner Gearmotors.

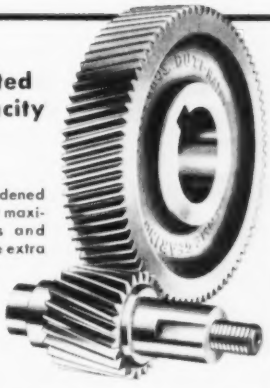
This extension to the Wagner line provides compact motorized drives, with both motor and gear housing of corrosion-resistant cast iron. Available with the latest NEMA Frame open protected or totally enclosed fan-cooled motors, they combine Wagner motor dependability with rugged, simplified gear units to give you speed reduction equipment designed for greater capacity and longer life in ordinary up to rough service.

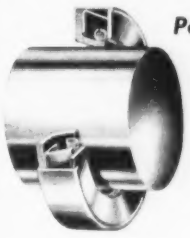
Wagner Gearmotors offer a wide variety of sizes in single, double, triple or quadruple reductions, horizontal or vertical foot or flange mountings—speeds from 7½ to 780 RPM. Write for Bulletin MU-227.

Whether you specify or apply power transmission equipment, your nearby Wagner Sales Engineer will be glad to help you select the right drive for your applications.

Heat treated high capacity helical gears

Gears are hardened after cutting, for maximum hardness and accuracy, to give extra capacity and longer wear life.





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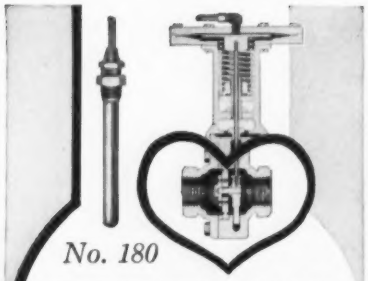

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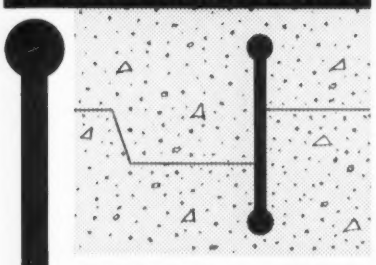
FOR MASONRY CONSTRUCTION JOINTS



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See Sweet's, or Write for Information.

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EQUIPMENT and SUPPLY CO.
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Consulting Engineers' Calendar

June 3. American Institute of Consulting Engineers; Luncheon Meeting, Engineers Club, New York, N.Y.

June 4-5. The University of Wisconsin Extension Div.; Consulting Engineers Institute, The University of Wisconsin, Madison, Wisconsin.

June 11-13. Michigan Society of Professional Engineers; Annual Convention, Gratiot Inn, Port Huron, Mich.

June 14-18. American Society of Mechanical Engineers; Semiannual Meeting, Chase-Park Plaza, St. Louis, Mo.

June 15-17. American Nuclear Society; Annual Meeting, Gatlinburg, Tenn.

June 17-20. National Society of Professional Engineers; Annual Meeting, Commodore Hotel, New York, N.Y.

June 21-26. American Institute of Electrical Engineers; Summer and Pacific General Meeting, Olympic Hotel, Seattle, Washington.

June 22-23. Illuminating Engineering Society; Great Lakes Regional Conference, Statler Hotel, Buffalo, N.Y.

July 1-3. American Society of Civil Engineers; Hydraulics Conference, Colorado State U., Fort Collins, Colo.

August 9-12. American Society of Mechanical Engineers, American Institute of Chemical Engineers; Heat-Transfer Conference, University of Connecticut, Storrs, Connecticut.

Aug. 23-26. American Institute of Electrical Engineers; Petroleum Industry Conference, Wilton Hotel, Long Beach, California.

Sept. 9. American Institute of Consulting Engineers; Luncheon Meeting, Engineers Club, New York, N.Y.

Sept. 20-23. American Society of Mechanical Engineers; Petroleum-Mechanical Engineering Conference, Rice Hotel, Houston, Texas.

Sept. 27-30. American Institute of Chemical Engineers; National Meeting, Hotel St. Paul, St. Paul, Minn.

Sept. 30-Oct. 2. American Society of Mechanical Engineers, American Institute of Electrical Engineers; National Power Conference, Hotel Muehlebach, Kansas City, Missouri.

Oct. 5-8. National Association of Corrosion Engineers, Northeast Region Conference, Lord Baltimore Hotel, Baltimore, Maryland.

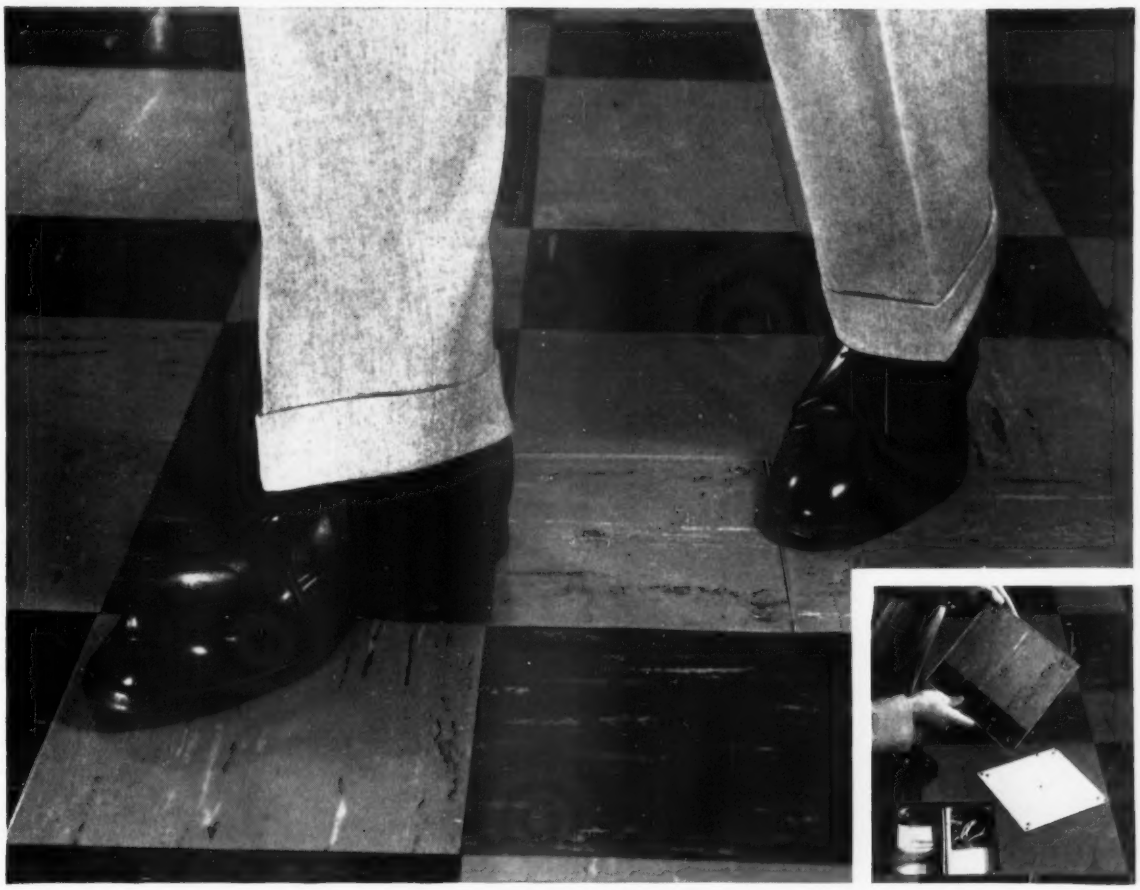
Oct. 11-16. American Institute of Electrical Engineers; Fall General Meeting, Morrison Hotel, Chicago, Illinois.

Oct. 19-23. American Society of Civil Engineers; Annual Convention, Hotel Statler, Washington, D. C.

Oct. 20-22. American Standards Association; 10th National Conference on Standards, Sheraton-Cadillac Hotel, Detroit, Michigan.

Oct. 26-28. American Road Builders' Association; National Highway Conference, Leamington Hotel, Minneapolis, Minnesota.

Nov. 16-19. American Institute of Electrical Engineers; Fifth Conference on Magnetism and Magnetic Materials; Sheraton-Cadillac Hotel, Detroit, Michigan.



Puzzle: Find the Spang Floor Pan! In this unretouched close-up photo, it's barely visible between the man's feet. From a few feet away, it's difficult to spot this access-box covering. Only 1/16" rim and corner and center screws are visible.

(Right inset) Linoleum tile is easily and accurately cut to fit recess in this square Spang Floor Pan design. Center and corner screws hold floor pan and access box plate firmly in place. Square access box provides maximum working area.

1/16" rim makes this SPANG floor pan practically invisible!

New square aluminum alloy recessed pan covers underfloor duct access openings . . . provides smooth, unbroken floor pattern

Now, SPANG offers you another exclusive feature which enhances appearance of the finished building equipped with SPANG Underfloor Duct and SPANG Headerduct electrical raceways . . . the SPANG Floor Pan.

This new square pan, which covers duct access openings, does not present the problem of thick, conspicuous pan rims or circular cuts in the floor. It is constructed of 1/16" stamped aluminum alloy. Floor tile can be quickly and accurately cut to cover it.

The SPANG Floor Pan is recessed in the access box cover to make the tile flush with the rest of the floor. All that shows are the 1/16" rim and retaining screws. From a few feet away, it's practically invisible!

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Distributed in Canada by G. H. Wood & Co., Ltd.

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Amvit VITRIFIED CLAY LINER PLATES

protect concrete structures from disintegration

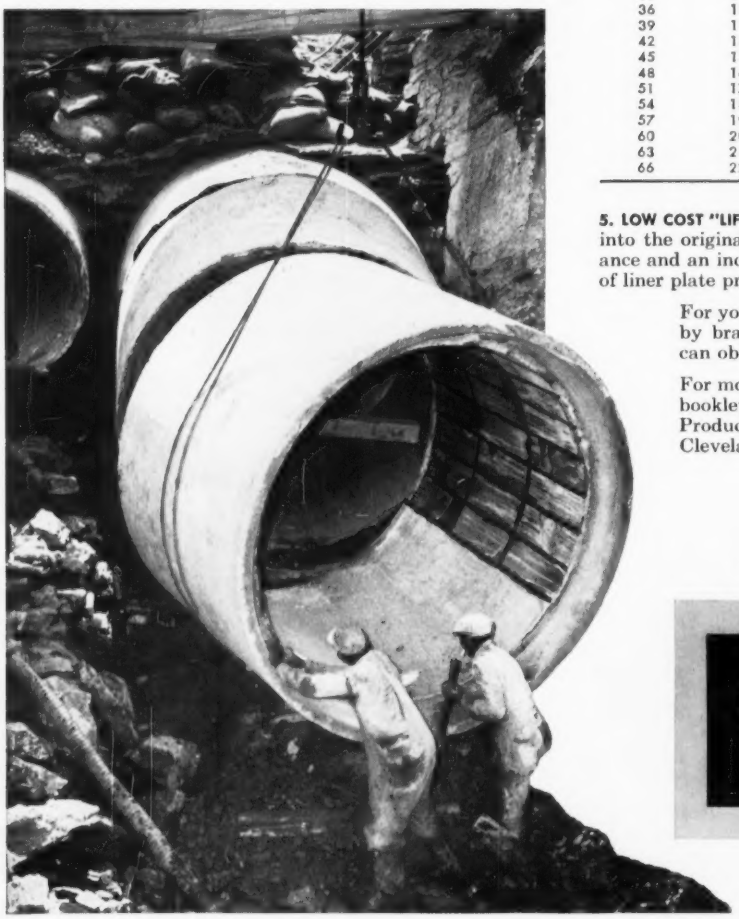
CLAY LINER PLATES ARE UNAFFECTED BY EROSION, ABRASION OR CORROSIVE ACIDS OR GASES

For complete protection of concrete pipe sewers, industrial sewers, acid vats, sewage treatment tanks, neutralizing baths, culverts, retaining walls, and bridges use Amvit clay liner plates for these five big reasons:

1. RESISTS ACID ATTACK — Amvit Liner plates are specially manufactured to meet all application requirements which entail resistance to acids, alkalies, and chemical reaction. They are made of the same high grade clays that go into famous Amvit sewer pipe. They are formed, dried, and vitrified to obtain clay pipe density and hardness.

2. PREVENTS ABRASION — Amvit Liner plates are not affected by the wearing action of sand, rocks, gravel, or other solids often encountered in streams and rivers. They protect all surfaces against corrosion and abrasion.

3. EASY INSTALLATION — Amvit Clay Liner Plates, hardened, glazed, and durable, permanently bond and lock to masonry and concrete work. They are easily installed on concrete forms and are sized according to standardized specifications for uniform spacing.



4. SIZES FOR EVERY JOB — To meet the applications of liner plates in industry, sewerage, and drainage, they are manufactured flat or curved, in 24-inch lengths, 9 inches wide. Lengths under 24 inches for special applications are available on request.

STANDARDS FOR CURVED LINER PLATES

Diameter Sewer	Pieces Required For Circle	Radius	Diameter Sewer	Pieces Required For Circle	Radius
Inches	Number	Inches	Inches	Number	Inches
24	8	12	69	23	33
27	9	13½	72	24	33
30	10	16½	78	26	45
33	11	16½	84	28	45
36	12	18	90	30	45
39	13	21	96	32	45
42	14	21	102	34	45
45	15	21	108	36	60
48	16	24	114	38	60
51	17	26¼	120	40	60
54	18	26¼	126	42	60
57	19	26¼	132	44	60
60	20	33	138	46	60
63	21	33	144	48	72
66	22	33			

5. LOW COST "LIFE INSURANCE" — Building Amvit Liner Plates into the original structure assures a reduction in maintenance and an increase in life expectancy far beyond the cost of liner plate protection.

For your next job, specify *Amvit Clay Liner Plates* by brand. Your local concrete pipe manufacturer can obtain them on short notice.

For more information, write or call for our detailed booklet on Amvit Liner Plates. American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.

SINCE 1848

AMERICAN

American Vitrified Products Company

NATIONAL CITY BANK BUILDING
CLEVELAND, OHIO

A-B QUALITY

ALLEN-BRADLEY
Solenoid Starters give

MORE MILLIONS OF TROUBLE FREE OPERATIONS

. . . and for good reasons

• ONE MOVING PART

With this simple solenoid design, there's virtually nothing to go wrong—all trouble-causing bearings, pivots, and flexible jumpers have been eliminated.

• DOUBLE BREAK, SILVER ALLOY CONTACTS

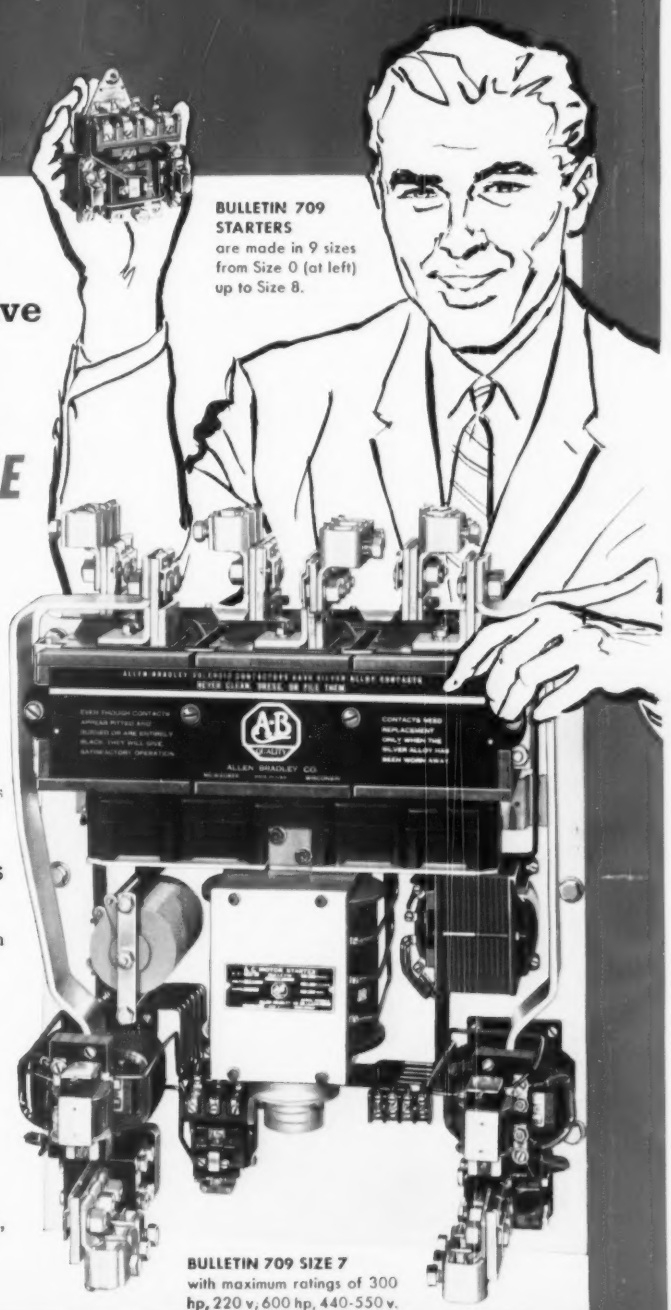
Allen-Bradley silver alloy contacts never require maintenance. They are always in perfect operating condition . . . and remain so until completely worn away.

• SIMPLE UP-AND-DOWN MOTION

The virtually frictionless, straight line vertical motion provides uniform contact pressure at all times—and assures consistent, rapid operation of the contactor.

• RELIABLE OVERLOAD PROTECTION

All A-B starters are equipped with two permanently accurate and reliable overload relays that protect motors against "burnouts." Three overload relays can be furnished.



BULLETIN 709 STARTERS are made in 9 sizes from Size 0 (at left) up to Size 8.

BULLETIN 709 SIZE 7 with maximum ratings of 300 hp, 220 v; 600 hp, 440-550 v.

ALLEN-BRADLEY

Allen-Bradley Co., 216 W. Greenfield Ave., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

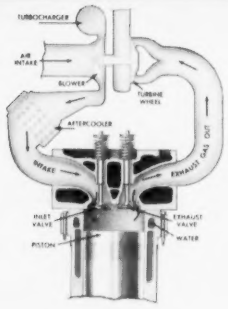
How much do you know about

TURBOCHARGING AN ENGINE?

An interview with William M. Kauffmann, Chief Engineer of the Engine Division, Worthington Corporation. Turbocharging of high-output engines is an accomplished fact. Last year *100%* of all power engines built by Worthington were equipped with turbochargers. In this short interview Mr. Kauffmann outlines some of the design philosophy behind turbocharging. If you would like to have more information about Worthington's line of turbocharged engines and engine compressors, won't you write to Worthington Corporation, Section 43-7, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.

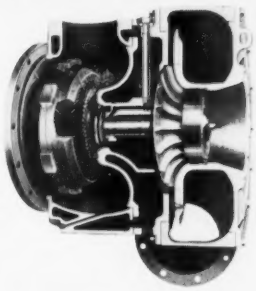
WORTHINGTON

Q. WHAT BASIC PRINCIPLES ARE INVOLVED IN HIGH-OUTPUT TURBOCHARGING?



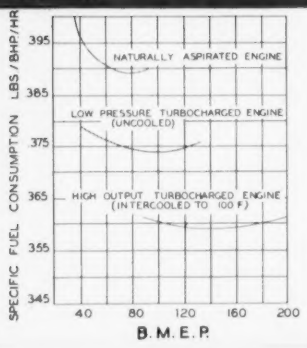
A. The method I favor uses design principles that produce optimum mechanical and thermal operating efficiency. For example, four-valve head design gives higher volumetric efficiency; thru-flow scavenging results in increased cool air flow through the cylinder; flood cooled pistons reduce ring belt temperature; dry exhaust manifold lowers heat rejection to cooling system; air aftercooling reduces initial cycle temperature and thermal load; high pressure turbochargers give high air excess at moderate charging pressures due to improved combined efficiencies of gas turbine and blower; fixed valve overlap assures best scavenge ratio and increased trapped air volume; high velocity jacket water cooling reduces liner temperature.

Q. HOW ABOUT TURBOCHARGER MAINTENANCE AND RELIABILITY?



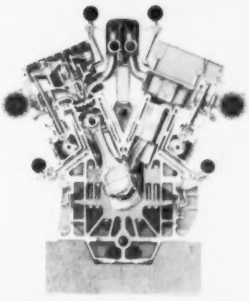
A. An integrated turbolubricating system permits using proper lubricant for the turbocharger. A separate sump, full-flow filter and pump provide complete rotating element protection for long life with only periodic inspection. These turbochargers are of rugged design and are thoroughly field proven. Normal full load speed is conservative, usually not exceeding 80% of supplier maximum recommendation.

Q. HOW MUCH IMPROVEMENT HAS TURBOCHARGING MADE IN FUEL ECONOMY?



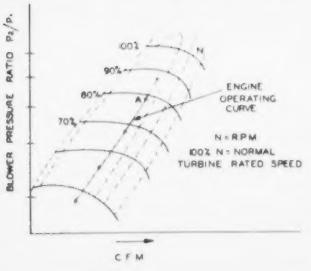
A. Paradoxically, modern high-output Diesels exhibit far better fuel consumption than older, low pressure charged units. Fuel consumptions of .360 lbs./bhp/hr. or lower, on fuel oil, and 6250 Btu/bhp/hr. or under, on dual fuel or spark ignition operation are not unusual. This makes thermal efficiencies of 40% or over, available to power users. Result: additional first cost economy for heat exchanger equipment and auxiliary sizes, plus the better plant economy.

Q. WHAT ABOUT TURBOCHARGING A GAS ENGINE?



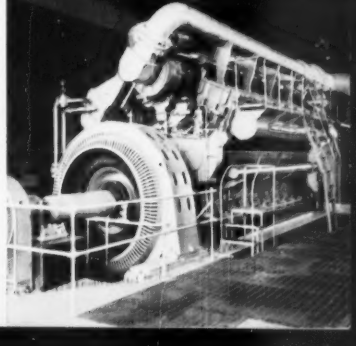
A. The first turbocharged gas burning diesel was conceived by Worthington's engineers in 1943, and demonstrated to the public early in 1945. This design used low pressure gas, admitted into the air inlet passage, and represented a new concept for gas operation. Air-fuel ratio control developments (Worthington's "Turbomizer") for spark ignition engines, followed. Since many basic dual fuel and spark ignition engine components were interchangeable, the Tri-Power engine was the next logical step. This gives turbocharged diesel oil, dual fuel gas, or spark ignition gas engine operating with the same unit, allowing use of most economical fuels.

Q. ARE SEA LEVEL RATINGS AT ALTITUDE POSSIBLE?



A. Reduced barometric pressure at altitude increases available gas turbine power, thus allowing packing as much air into the engine as at sea level. Turbochargers with blower pressure ratios up to 3.0, make possible sea level ratings at altitudes up to 8000 ft. Turboblower discharge air aftercooling gives these engines low mean cycle temperatures consistent with sea level operation. Benefit: less floor space and building size than for previously derated units. Such units have given exceptionally reliable service, matching sea level overload performance.

Q. IS TURBOCOOLING NECESSARY?



A. Large bore, slow speed, gas engines suffer from low knock limit due to small cooling area per unit cylinder volume. Here, extreme measures to cool the air are necessary, although possibly complex and costly for moderate ratings. High cylinder surface-to-volume ratio engines (such as Worthington's SW14) exhibit high knock limit and will operate at high bmep with only normal aftercooling. This means simpler construction and operation.